5347
36/2

ON THE ELEMENTARY PRINCIPLES OF NATURE; AND THE SIMPLE LAWS BY WHICH THEY ARE GOVERNED.

BEING AN ATTEMPT
TO DEMONSTRATE THEIR EXISTENCE,
AND
TO EXPLAIN THEIR MODE OF ACTION;
PARTICULARLY IN THOSE STATES, IN WHICH,
THEY PRODUCE THE ATTRACTIONS OF
COHESION, GRAVITATION, MAGNETISM
AND ELECTRICITY;
AND ALSO
FIRE, LIGHT, AND WATER.

BY E. PEART, M. D.

GAINSBOROUGH:
PRINTED BY H. MOZLEY; AND SOLD BY J. EDWARDS,
PALL-MALL, LONDON, AND C. ELLIOT, IN
PARLIAMENT-SQUARE, EDINBURGH.

M.DCC.LXXXIX.

COMMISSIONERS OF PATENTS FOR INVENTIONS

BRITISH MUSEUM

4493

PREFACE.

ABOUT twelve months ago, I publiſhed an Eſſay on *The* GENERATION *of* ANIMAL HEAT, which was preceded by an *Introduction*, pointing out the Elementary Principles of Nature, and the fundamental Laws by which they are Governed; — At the ſame time, intimating my intentions of publiſhing, a *full Explanation* of thoſe Principles and Laws.

That Explanation, I now offer to the world, in the following Pages.

I meant to have extended it to the particular agents and operations of *Chemiſtry*, but, being uncertain whether even this will be read, or not, I thought it beſt to ſuſpend my reſearches, at leaſt for the preſent.

PATENT OFFICE
THE
LIBRARY

CONTENTS.

SECTION I.

PAGE

On the Principles of Nature, evidently preſenting themſelves to the Mind; as being eſſentially neceſſary, to produce the various appearances, every where offering themſelves to its Contemplation. 1

SECTION II.

An Attempt to prove, that the Elementary Principles, propoſed in the preceding Section, in reality Exiſt; and to point them out in Nature; ſo that they may be known, and diſtinguiſhed from each other with certainty. 43

13

PAGE

SECTION III.

On the Earthy Principle. 88

SECTION IV.

On the Acidifying Principle. 105

SECTION V.

On Phlogiſton. 113

SECTION VI.

On Æther. 122

SECTION VII.

On the Attraction of Coheſion, and the cauſes on which the different degrees of Solidity, or Fluidity of bodies, in the common temperature of heat, depend. 113

SECTION VIII.

On Gravity, or the Power by which diſtant bodies attract each other. 148

SECTION IX.

On Magnetiſm. 161

SECTION X.

On Electricity. 178

SEC-

PAGE

SECTION XI.

On Fire. 214

SECTION XII.

On Light. 232

SECTION XIII.

On Water. 253

RECAPITULATION. 285

ERRATA.

N. B. *(b)* Signifies from the Bottom.

In ſome few places, *Subtil* is printed for *Subtile*; and in a great number of places, a *Colon* is put inſtead of a *Comma*.

Page 2 line 11 and 12—and p. 138 l. 5 *(b)* for *indiſtructible*, read *indeſtructible*.

—— 12 l. 4 *(b)* for *its evident*, read *'tis evident*.

—— 23 l. 5 for *fixed particles*, read *a fixed particle*.

—— 35 l. 6 *(b)* for *progeſſive*, read *progreſſive*.

—— 36 l. 12 dele the *comma* after *ſolid*.

—— 44 l. 12 for *ennumerate*, read *enumerate*.

—— 61 l. 3 for *meduim*, read *medium*.

—— 68 l. 9 *(b)* for *well unite*, read *will unite*.

—— 87 l. 1 in ſome few copies, *fully phlogiſton* was printed inſtead of *fully proved*.

—— 102 l. 10 *(b)* and p. 290 l. 5 for *invelope*, read *envelop*.

—— 111 l. 10 for *depend*, read *depends*.

—— 236 l. 10 for *charged*, read *changed*.

—— 249 l. 6 for *expelled*, read *repelled*.

—— 304 l. 8 *(b)* for *white*, read *whiteneſs*.

AN EXPLANATION, OF THE ELEMENTARY PRINCIPLES OF NATURE.

SECTION I.

On the Principles of Nature, evidently preſenting themſelves to the mind; as being eſſentially neceſſary, to produce the various appearances, every where offering themſelves to its contemplation.

IF we take a comprehenſive view of nature, we cannot avoid perceiving the exiſtence of *matter*, in all the different ſtates, from the ponderous and impenetrable ſolid, to the moſt ſubtil and expanſive fluid. But whatever be the ſtate in which it is, we ſtill are convinced of its materiality, by its action upon our material organs of ſenſation; nothing being capable of exciting the perception, or idea of its exiſtence, preſence, and action, but what is material.

Every thing therefore which we can perceive, and know to exiſt, muſt be material, howſoever rare or expanded; and the only definition of a particle of matter, which I wiſh at preſent to give, is, that it is an impenetrable point or atom, indiſtructible, and conſequently by no natural means diviſible.

All things therefore exiſting, muſt be compoſed of particles of matter; and their different ſtates, with reſpect to ſolidity, muſt depend upon the manner, in which thoſe particles are combined with each other; the nearer they approach in every direction, the more ſolid and ponderous the compound. And upon this mode of arrangement alone, all the various ſtates of ſolidity and fluidity muſt depend; becauſe we can never conceive it poſſible, for a particle of matter, to act at a diſtance from itſelf, or where it is not; therefore, there can be no ſuch power exiſting as repulſion, or attraction, unleſs the particles attracting, or repelling be in contact.

We may arrange every thing in nature under *four* general *heads* or *claſſes*, with reſpect to their ſtates of ſolidity; theſe will be Solids, Liquids, aeriform Fluids, and highly expanſive Fluids.

The *firſt claſs* comprehends every body or ſubſtance, whoſe component particles nearly approach, and are forcibly attracted to each other; ſo as to ſtrongly reſiſt any power, applied to ſeparate them from the ſtate they are in, and the preſent connexion they have, with reſpect to each other. To this claſs belongs every thing which we in general call a *Solid* body, or ſubſtance; for inſtance, Stones, Metals, Wood, &c.

The *ſecond claſs* contains thoſe parts of nature, which ſtrongly reſemble the former; except in this reſpect, that the particles of which they are compoſed, have little attraction amongſt themſelves; conſequently, by any moderate force, they may be made to recede, and eaſily move amongſt each other in any direction. Of this kind are all liquids, as Water, Quickſilver, Oils, Spirits, &c.

Of the *third claſs*, are all thoſe rare, expanſive fluids, which are known by the names of Gaſes, Airs, or elaſtic fluids; and alſo vapours. Theſe though as evidently material as the other, contain fewer ſolid particles, with very large interſtices; and though they have weight, and a certain degree of ſolidity, or power of reſiſtance, yet, that weight and ſolidity are ſmall, when compared with the ſubſtances of the former claſſes; and conſequently, the number of ſolid particles they contain, muſt be far leſs, than the number compoſing a ſolid, or liquid of equal extent.

To the *fourth claſs* belong thoſe highly expanſive, ſubtil, and peculiar fluids, Fire, Light, and the Magnetic and Electric fluids. Their exiſtence is known by their actions; and conſequently they are as certainly material, as the ground upon which we tread; for nothing can act upon matter, but what is material: nothing can produce ſenſation, or the perception of its action upon our material organs, but what exiſts; and whatever we know to exiſt, muſt be material.

It appears then, that the moſt ponderous ſolid, and moſt ſubtil fluid, are compoſed of particles equally material, and impenetrable; but the number of ſolid particles contained in a cubic inch of air, cannot be nearly equal to the number contained in an equal bulk of metal, as is evident from the difference of their ſpecific gravities; therefore 'tis certain that thoſe ſolid particles cannot be ſo near to each other in air, as they are in metals.

But it hath been mentioned, and cannot be diſproved, that no particle of matter can act where it is not; therefore, the particles forming air, muſt be in contact with each other, from the centre to the circumference; but as a certain extent, or bulk of air, is not ſo denſe or ſolid, as an equal bulk or extent of metal: it muſt contain fewer particles of matter, and more interſtices; conſequently, if the particles of matter are in contact, from the centre to the circumference of a particle of air, the cauſe of its *rarity* muſt be, that the lines of contiguous particles, forming that extent, cannot be in contact, but muſt form *radii* of particles, diverging from each other, in proportion as they recede from the centre.

Pure air we know when decompoſed, ſo as to loſe its aeriform ſtate, affords a ſmall quantity of acid; in a ſtate occupying much leſs ſpace than before; and much more ſolid or denſe. Thoſe particles of acid therefore, when in the ſtate of pure air, could not be nearly in contact, but were kept from each other at a conſiderable diſtance; conſequently, not being capable of acting where they were not, in that expanſive ſtate, they muſt have been kept aſunder, by the interpoſition of ſome *other* particles of matter, ſurrounding them in lines, like radii, in all directions, diverging from each other as they receded from the acid particles as centres, ſo as to form atmoſpheres around them; which reſiſting each other, when brought into contact, kept thoſe acid centres at a certain diſtance; in the ſame manner, as two light balls, electrified with the ſame kind of electricity, repel, or keep each other at a diſtance, proportionate to the extent of their reſpective atmoſpheres of electric fluid; or in the ſame manner, as two ſimilar poles of two magnets, refuſe to approach each other. For lines of particles, forming radii, extending in all directions from different centres, cannot penetrate, or approach each other, nearer than where they come into contact, becauſe, though the lines of particles at the centre of contact, are parallel, or in the ſame direction, the ſurrounding diverging radii will act upon each other at certain angles, approaching to a right angle, as they recede from the centre of contact; conſequently, two ſimilar atmoſpheres will not be able to penetrate each other.

It appears therefore, that the acidifying particles forming the baſe of pure air, excite certain particles of matter, to attract each other, ſo as to arrange themſelves in an atmoſpheric form, like radii, round each acid particle as a centre; and that the rarity, elaſticity, and levity of pure air, depend upon this atmoſpheric arrangement; where the lines of particles, diverging as they recede from the acid centre leave large interſtices, between them, and form a particle of *Air*, light, yielding, elaſtic, and yet ſufficiently ſolid, to keep every ſimilar particle at a diſtance, equal to its extent; if not overpowered by preſſure ab extra.

If a little nitrous acid be put into a phial, and expoſed to the action of ſolar light; a quantity of pure air will be produced: but not without being expoſed to the light; conſequently the particles of acid do not produce pure air, by their own arrangement, amongſt themſelves; but, by their affinity to light, or *ſomething* partly compoſing it, they attract to themſelves atmoſpheres of that *ſomething*, and form pure air; therefore, a particle of pure air, is a particle of acid, ſurrounded by an atmoſphere of particles of ſome *other* kind, attracted from light; thoſe particles by the attraction of the acid, being united to it, and excited to attract each other, ſo as to arrange themſelves into lines, like radii, ſurrounding the particle of acid in an atmoſpheric form; therefore we may naturally conclude, that there are *two* kinds of matter; a fixed kind, forming the baſes of all ſolid particles, or compoſitions of ſolid particles; and an *active* kind, whoſe particles being attracted by the fixed particles of matter, become excited to attract each other; ſo as to form lines in an atmoſpheric form, ſurrounding the fixed central particles; and diverging from each other, as they recede from their exciting centres; in the ſame manner, as a number of iron filings when expoſed to the action of a magnet, are excited to attract each other, and arrange themſelves in a certain manner, like an atmoſphere around it.

Inflammable air reſembles pure air in its expanſibility, rarity and levity, in which laſt reſpect it even greatly exceeds it; conſequently it contains but few particles of fixed matter, and thoſe particles are kept at a diſtance from each other, by the atmoſpheric arrangement of active particles around them.

If a quantity of this inflammable air, be mixt with a proper proportion of pure air, and the attraction of thoſe atmoſpheres to their reſpective centres, be weakened by being extended and dilated by a certain degree of heat; they will penetrate, and unite with each other, ſo as to bring their reſpective fixed centres into contact; which unite and form water; by which union the atmoſpheres being diſengaged, combine and form fire, or light; conſequently the atmoſpheres of the particles of inflammable air, have an affinity to the atmoſpheres of the particles of pure air, by which they unite, and draw their reſpective centres into contact: but atmoſpheres ſurrounding particles of pure, or inflammable air, have no attraction, or power of penetrating and uniting with ſimilar atmoſpheres of the *ſame* kind of air; therefore the *atmoſphere* ſurrounding a particle of inflammable air, is of a different kind, from that inveloping the acid particle, and producing pure air; as having an attraction of union to it, exceeding the attraction of arrangement among its own ſimilar particles; and reſembles the atmoſphere ſurrounding a ball of cork, poſitively electrified; which will not unite with another, with a ſimilar electric atmoſphere; but rapidly ruſhes into union with a ball ſurrounded by an atmoſphere of the contrary electricity.

It appears therefore, that there are *two* kinds of *active particles;* that the particles of either kind being attracted by fixed particles of matter, become excited to arrangement, in an atmoſpheric form, round their reſpective fixed particles; that each hath an attraction for the other kind, when in a ſimilar ſtate: ſufficient to deſtroy its peculiar arrangement; and that the conſequence of that union, is, an *united effort*, to draw their reſpective centres into contact.

The particles of matter, compoſing the univerſe, and producing all the phenomena of nature, therefore, ſeem to be of *two* general kinds.

The *firſt* kind, are ſimple, impenetrable, or ſolid particles of matter, poſſeſſed of a powerful attraction, to particles of the other kind; theſe for conveniency, may be called *fixed* or *ſolid* particles of matter; as forming the ſolid baſes, or evident ſubſtance of the firſt and ſecond claſſes of matter; and affording the fixed centres, round which the particles of the other kind, arrange themſelves like atmoſpheres, to form the aeriform fluids of the third claſs.

The *ſecond* kind of matter, are ſimple, ſolid particles, poſſeſſing a kind of polarity; by which, when attracted by the fixed particles of the firſt kind, becoming excited, they attract each other into cloſe contact, ſo as to form lines of contiguous particles, extending like radii, in all directions from the centre; which lines muſt recede from each other, as their diſtance from the centre increaſes.

But as their excitement, and arrangement, depend upon the attraction of the fixed central particle: 'its evident, that their attractive force of arrangement, muſt be leſs, as their diſtance from the exciting centre becomes greater.

The particles of this ſecond kind, I call, for the ſake of diſtinction, *active particles* of matter.

But though all the active particles, reſemble each other, in being equally attracted by fixed matter; and by that means excited to atmoſpheric arrangement; they are certainly of *two* different ſorts. Active particles of either ſort, when excited, attracting ſimilar particles to arrangement; and two atmoſpheres of the ſame kind of active particles, having no power of attracting or approaching each other, nearer than where they come into contact; while radii of particles forming atmoſpheres, of the *oppoſite*, or *different* ſorts, attract each other into parallel lines, extending from one fixed centre to the other; which by their united force, they draw into contact.

That this diverſity of active particles, actually exiſts, is fully proved by both electricity, and magnetiſm. For inſtance, two light cork balls, if poſitively electrified, will not approach near each other; but if one be poſſitively, and the other negatively electrified, they will ruſh into contact with violence. In like manner the north pole of one magnet, will not approach the north pole of another; but will rapidly meet the ſouth pole, and retain it with force.

It appears therefore evident, that there are *two active* powers in nature; or *two active material* fluids, eſſentially different in their properties, or diſpoſitions. Each of them hath an attraction for fixed or ſolid matter; but certain circumſtances render the ſame ſubſtance, attractive to one active fluid, but not to the other. And 'tis indeed neceſſary, that there ſhould be *two active principles* of different natures; becauſe, if there were not, the ſimplicity of ſolid matter, and the uniform, equal attraction, of *one* ſimple active fluid, would unite all nature, into one homogeneous, inorganic, lifeleſs maſs.

Since then it is neceſſary, and natural to conclude, that there are *two active* fluids, in nature, of different properties, and diſpoſitions, though agreeing in ſubtilty, expanſibility, the property of attraction to fixed matter, and atmoſpheric arrangement around it; we muſt likewiſe allow, that they have an attraction for each other. For if a certain body, poſitively electrified, or ſurrounded by an atmoſphere of one active principle, will not come near another in the ſame ſtate; it ſhews that each body attracts its own electric atmoſphere, and recedes, if poſſible, from the ſimilar atmoſphere ſurrounding the other; but when preſented to a body negatively electrified, they mutually ruſh into contact; becauſe the body negatively electrified, hath an atmoſphere formed by the other active fluid. The ſame in magnetiſm; the two active fluids, form ſimilar atmoſpheres, around the oppoſite ends of the needle; the ſame fluid, always ſurrounding the ends of different needles, pointing the ſame way; in conſequence of which, the ſimilar ends will not unite; but the oppoſite ends will, forcibly; becauſe the active fluids of the two oppoſite poles of the needles, being different, attract each other. The ſame reaſon is to be given, for the union even of a particle of acid with an alkali.

We may therefore conclude, that beſides the ſimple particles of *fixed* matter, there are *two* kinds of *active* particles in nature; that the *fixed* particles, equally attract *both* kinds of active particles; that either kind by that attraction, becomes excited to *atmoſpheric arrangement* around the fixed centre: by means of the peculiar property, or polarity, by which active particles of the ſame kind, attract each other, ſo as to form lines, extending from the fixed matter, like radii from a centre; that the atmoſpheric radii of *different* kinds, have an attraction of combination with each other, when in ſimilar ſtates of excitement, by which they draw their reſpective fixed centres into contact; but that when in the atmoſpheric ſtate, neither of theſe active fluids, will attract the *ſame* kind of fluid, in the ſame manner ſurrounding its reſpective ſolid centre; becauſe their attraction is exerted upon the centres themſelves, which each reſpectively is united to. But if one centre has a greater atmoſphere than the other, that other will attract ſo much from it, as to make an equilibriuim; where each atmoſphere will extend to an equal diſtance from its centre.

Having now found matter, conſiſting of ſolid or fixed particles; and two active fluids, or kinds of active particles, each having an affinity with the ſolid or fixed particles, round which they form atmoſpheres: which will not unite with ſimilar atmoſpheres; but having an attraction for each other, by which, particles of ſolid matter poſſeſſed of atmoſpheres of the different fluids, are attracted to unite; we muſt next ſee, what will be the reſult of their union with thoſe fixed particles of matter; and then with each other.

Theſe two active principles, being *equally* attracted by the fixed particles of matter, will each attract and unite itſelf, to the fixed particles expoſed to it; and conſequently, each ſolid particle, will form a *centre* to an atmoſphere, of one or other of theſe active kinds of particles, (which for the ſake of conveniency when in that atmoſpheric ſtate of excitement, I ſhall occaſionally call active fluids,) by which the very properties of theſe fluids, will be united to the particles of ſolid or fixed matter; and that union will form a compound, where the inertia of the ſolid particles, and the elaſticity and rarity of the active fluids, muſt be each diminiſhed, by their mutual attraction and union.

These compound particles, will therefore have partly the ſame general properties, as the active fluids themſelves have. Particles with ſimilar atmoſpheres will not unite, but with different atmoſpheres they will. And theſe active fluids being equally and univerſally diffuſed as far as creation extends; and being equally and powerfully attracted by the fixed particles of matter: every fixed particle of matter muſt have an atmoſphere of either one or other of theſe active fluids; but as they are each equally attracted by ſolid matter, 'tis evident, that whichever of the fluids is firſt united to any ſolid particle, that atmoſphere to a certain extent, the particle muſt for ever retain; becauſe that fixed particle cannot meet with any thing, to which it hath a ſtronger affinity; and that active atmoſphere can never be more forcibly attracted by any other power, than that, with which it is already combined. Conſequently, that atmoſphere will never be attracted from its ſolid centre; and that centre cannot be immediately acted upon, but by firſt deſtroying its atmoſphere; which can never happen, as nothing can attract it more ſtrongly than its centre does, even were it diſengaged; but by being already united to it, it muſt for ever ſo remain, to a certain extent or diſtance from its fixed particle; as its attraction for every other matter, is weakened in proportion as it attracts its centre.

Every ſolid particle of matter, therefore, actuates an atmoſphere of one or other of the two active fluids; but as thoſe fluids are different from, and have an attraction to each other; ſo muſt the particles, which as atmoſpheres they actuate; therefore, every particle of ſolid matter, muſt be thus actuated; and the whole will form *two claſses*, or *principles*, each poſſeſſed of different properties: and each having an affinity, and power of union with the other.

Of one or other, or both of theſe claſſes of actuated particles, all the various ſubſtances in nature, which contain any fixed matter as their baſes or in their compoſitions, muſt be formed; ſuch are thoſe of the *firſt*, *ſecond*, and *third* claſſes of matter; and all the other ſubſtances, or fluids, exiſting, howſoever ſubtil or elaſtic, muſt be produced by the two active fluids, ſeparately or conjointly; ſuch are the highly expanſive fluids of the *fourth* claſs.

If we chemically examine the different ſolids, fluids and aeriform ſubſtances in nature, we in reality find, that *all* of them contain an *earthy*, or an *acid* baſe or matter; an alkali and an earth, are of the ſame nature, or the ſame principle, in different ſtates of combination: but the alkali ſeems to be the ſtrongeſt in its general affinities, and conſequently the moſt active; but that activity or alkalinity, ſeems to be a quality depending upon circumſtances: therefore, I include *both* under the general title of *earthy* matter; having a ſtrong attraction to the other, the *acid* matter.

Theſe two ſubſtances being of *different* natures, and having a ſtrong attraction to, and power of uniting with each other; are the two claſſes of *ſolid*, or *fixed* particles, with atmoſpheres of the *two different active* fluids; I ſhall therefore call the fixed particles of matter, ſurrounded by *one* of the active fluids, the *earthy principle*; and thoſe particles, having an atmoſphere formed by the *other* active matter, the *acidifying principle*; and theſe are the two *ſolid* principles of nature; compounded of *ſimilar* central particles of ſolid or fixed matter, as baſes or centres, to atmoſpheres of the *two different* active fluids.

And now, having pointed out the two more *ſolid* principles of nature, and diſtinguiſhed them by proper names, agreeable to thoſe which are univerſally adopted; 'tis neceſſary, to diſtinguiſh the other two, the *active* principles, by their reſpective names alſo.

One of them is known, admitted, and named already; 'tis therefore only neceſſary to point it out, and aſſign to it, the name univerſally given to it.

To arrive at this diſtinction, we muſt firſt of all ſay, that the *earthy principle* is a particle of *fixed* matter, with an atmoſphere of *one* of the active fluids; that this atmoſpheric, or compound particle, will not unite with a ſimilar one; but will, with one formed by the other active fluid. A metal, is allowed to be formed of an earth, united to *Phlogiſton*; that is, a metal is compoſed of a number of particles of earth, united together by their general attraction, to the active fluid, of a *different* nature, to their reſpective atmoſpheres; which interpoſed between the earthy particles, attracts each equally, and conſequently, draws them into coheſion, or a ſolid form. But this active fluid, giving coheſion, and metallic properties, to the earthy particles of which the metal is formed, Philoſophers and Chemiſts by general conſent, call *Phlogiſton*. *Phlogiſton* therefore, is the name by which *one* of theſe active fluids, ſhall continue to be diſtinguiſhed, in the following pages, as ſufficiently anſwering the purpoſe of diſcrimination.

But, if *phlogiſton* be the cementing principle, which attracts the particles of *earth* together, ſo as to form a metal: 'tis evident, that the *atmoſpheres* of the *earthy* particles, muſt be compoſed of the *other* active fluid; and likewiſe, that as the particles of the acidifying, and earthy principles, have *different* atmoſpheres, it muſt follow, that an *acidifying* particle, is formed of fixed particles of *matter*, ſurrounded by an atmoſphere of *phlogiſton.*

But what name are we to give to the *other* active fluid? Chemiſtry hath none for it, becauſe it hath entirely overlooked it. What name then ſhall we ſelect, or fabricate, for a *fluid*, by the Almighty wiſdom and power, endowed with active properties, and amazing ſubtilty and expanſibility? What name better than that which the truly great Sir Iſaac Newton gave, to a fluid, whoſe exiſtence he ſuppoſed neceſſary, and poſſeſſed of ſome properties, ſimilar to this now waiting for a name? that there is a fluid of this kind, in nature, Philoſophers allow; and with Sir Iſaac Newton and others call it *Æther*. By the name of *Æther*, I ſhall therefore again take the liberty to call it; not from fanciful fondneſs for the name, but becauſe it is a name given to a fluid of ſimilar ſubtilty and expanſibility, allowed to exiſt; and I retain that name, becauſe it anſwers my purpoſe, of diſtinguiſhing *it*, from the *other* active principle, known and admitted by the name of *Phlogiſton.*

And now we are able to ſay how an earthy particle is compoſed, for if an *acidifying* particle, hath a *different* atmoſphere from an earthy one, and an acidifying particle hath a *phlogiſtic* atmoſphere; 'tis evident, that the *earthy* principle, is a *fixed* particle of matter, actuated, by being intimately attracted by, and ſurrounded with, an *ætherial* atmoſphere.

The *elementary principles* of nature, therefore are *three*; *two active*, and *one* more paſſive or fixed. The *two* active principles, are *Æther* and *Phlogiſton*; and *each* of theſe, by their union with the more *paſſive* principle, forms a *ſecondary* or more fixed principle; a *fixed* particle of matter, with an *æthereal* atmoſphere, forms an *earthy particle* or *principle*; and with a *phlogiſtic* atmoſphere, the *acidifying* principle.

All nature is therefore formed, of *ſolid* or *fixed* particles, and particles poſſeſſed of atmoſpheric arrangement; that is of *matter* and the actuating property of *attraction.* For though there are *two active* principles, yet, they perfectly reſemble each other in their affinity to fixed matter, in their power of firmly uniting with it: in a peculiar polarity, or attraction of arrangement of their particles, in right lines, when excited: and in their general attraction to each other.

Were we to ſuppoſe, that there were *two* original kinds of ſolid particles, one earthy, the other acid; that one would unite with one active principle, and the other with the other active principle only; for inſtance, that an acid particle would combine with the ætherial, but not with the phlogiſtic principle; the ſyſtem would be more complex, and conſequently leſs perfect; for then we ſhould have occaſion for a principle, or property of *repulſion*, or a power of *choice*, by which one principle could chuſe with what other principle to unite, and which to repel or refuſe; for inſtance, the ætherial principle would have an attraction to the acid principle, or ſolid acid particle, to enable it to combine with it; and a repulſion, or power of refuſal, by which it would decline any union with the earthy principle. But this would be multiplying cauſes, principles, and properties, without neceſſity; for ſimple matter, poſſeſſed of the active property of general attraction, is alone ſufficient, to ſolve all the phenomena in nature; and conſequently the moſt conſentaneous to our ideas of the perfect wiſdom of the *Deity*; for to produce any *certain* effects, the *fewer* the principles, or inſtruments employed, the *more* exalted muſt be our idea, of the wiſdom which contrived or employed them.

It appears then, that the ſimpleſt, and moſt perfect idea which we can form of nature, is, that *all things* are produced by *ſolid* or *fixed* attractive matter, and *active* matter, having the property of attraction and atmoſpheric arrangement: that the *fixed* particles of matter, are equally capable of attracting every active particle: that the active particles, mutually and equally attract each other; and yet, that by the union of theſe *fixed* particles, with *one* part or kind of active matter, they become

come poſſeſſed of properties, *very different* from thoſe acquired by ſimilar fixed particles, united to *another* part or kind of that active matter; which ſhews, that, though every particle of active matter, is poſſeſſed of an *equal* power of attracting fixed matter, and uniting with it; and likewiſe of *arrangement* amongſt its *own* particles, ſo as to take an *atmoſpheric* form, around that fixed particle as a centre: yet, there is this eſſential difference in thoſe active particles, that *one* fixed particle, with an atmoſphere of æther, or phlogiſton, will *not* unite with, or come near *another* particle, ſurrounded with a *ſimilar* atmoſphere; but will ruſh into contact, with a particle poſſeſſed of a *different* atmoſphere. Thus a particle with an *ætherial* atmoſphere, will not approach near another, with an atmoſphere of æther; but will rapidly combine with a particle, whoſe atmoſphere is of *phlogiſton*. It is evident therefore, that though *all active* matter poſſeſſes an attraction to *fixed* matter, yet that there are *two* kinds of active matter, perfectly ſimilar in every reſpect but this, that *two* atmoſpheres of the *ſame* active fluid, when excited by union to two ſimilar fixed particles, cannot attract,

tract, or penetrate each other, ſo as to unite, or occupy a leſs ſpace than they do already; but, that two atmoſpheres *one* of *each* kind of active particles, can attract, and penetrate each other, ſo as to firmly combine, and occupy a ſpace when united, *leſs* than when ſeparate.

The reaſon why *ſimilar* atmoſpheres, will *not* penetrate each other, muſt be, that *ſimilar* particles, have only an attraction of *arrangement:* while particles of *different* kinds, have an attraction of *union*, overpowering the attraction of regular arrangement, when the two atmoſpheres are in a ſtate of equal excitement.

This polarity, or peculiar arrangement of active particles, being excited by their attraction to ſolid or fixed particles as centres: 'tis evident, that the nearer the centre, the greater the excitement, and the more powerful will be the property of arrangement.

With this difference between the attraction of *arrangement*, and attraction of *union* of the two fluids,

ids, when excited, ſo as to take an atmoſpheric form round their reſpective centres, we ſhall find no difficulty in ſolving the various appearances of nature, which may preſent; without having the leaſt occaſion to ſuppoſe, that the *ſame* particle of matter is poſſeſſed of both attraction and repulſion: which, cannot, conſiſtently with reaſon, be conceived as exiſtent at the *ſame* time, in the *ſame* particle of matter; for being oppoſite and equal effects, ariſing from the ſame particle or centre, they would deſtroy each other; neither need we ſuppoſe, that the ſame particle has a power of *choice*, by which it will unite to *one* ſimple particle, but refuſes every union with *another;* for all that is neceſſary to be proved, is, that *ſimilar* excited atmoſpheres, in this ſtate of arrangement, *cannot* unite or penetrate each other; but, that excited atmoſpheres of the *two different* active principles, can; and by that union, occupy *leſs ſpace* than before their combination; which I would explain in the following manner.

Suppoſe a quantity of diſengaged, or unexcited *æther*, having in that ſtate, no particular property but fluidity, or a tendency to keep itſelf in an equilibrium. If, *two* particles of *fixed* matter, be introduced to this æther, they will attract it powerfully: and by that attraction, the *contiguous* particles of *æther*, will become excited, ſo as to attract the ſurrounding particles, and they others; ſomething like what takes place, when a number of ſmall needles are arranged ſo as to form a line, by being applied, the extremity of one, to the end of another; or when a number of iron filings are promiſcuouſly ſpread; in that unexcited ſtate, they have no attraction, or action upon each other; but, if a *magnet* be applied to one extremity of this line of needles, or filings, that extremity is firmly attracted to the magnet, and all the other needles, or filings, inſtantly become *excited*, ſo as to attract each other. So it is with reſpect to the ætherial particles, the *firſt* being attracted by the *fixed* particle, becomes *excited*; and that excitement is communicated to every contiguous particle; ſo that lines of particles are formed, extending like radii from the centre, in every direction.

It is evident therefore, that theſe excited active fluids will *each* ſurround its centre in an atmoſpheric form: that atmoſpheres of the *ſame* kind, of *æther* for inſtance, cannot penetrate each other, mechanically, but muſt preſs upon, or reſiſt each other, if brought into contact: and that they have *no* other power of uniting, becauſe the *only* property which theſe excited ætherial particles have with reſpect to each other, is that of *arranging* themſelves around their reſpective centres. If one central fixed particle, indeed, poſſeſſes a *larger* atmoſphere of excited ætherial particles than another, in contact with it; the external particles will be *leſs* powerfully attracted, or excited to *it*, than by *that* which hath the *ſmaller* atmoſphere; in which caſe, the latter will by its ſuperior excitement, attract ſo much of the atmoſphere from the firſt, as to render the *two* particles poſſeſſed of *equal* atmoſpheres.

The ſame takes place, in ſimilar excited atmoſpheres of *phlogiſton;* which for the ſame reaſon, will preſs upon, or reſiſt each other, when brought in contact; but cannot unite.

But if an excited *ætherial* atmoſphere, be brought into contact, with an equally excited atmoſphere of *phlogiſton*: they will attract each other: the radii of *each*, will be attracted to inſinuate themſelves between the radii of the *other*: the ſpace they occupy, will become gradually *leſs*, as they approach: till at length, having penetrated, and united with each other, as much as poſſible, their force of attraction, or coheſion is become as great as it can be, in thoſe circumſtances; *each* atmoſphere attracting its *own* central particle, and the *oppoſite* atmoſphere alſo; ſo that not being able to quit their reſpective centres, ſo as to unite and form a diſengaged compound: they can only unite ſo far, as to form the attraction of coheſion, by drawing and holding the centres together.

It appears alſo, that the force with which æther and phlogiſton attract each other, is always proportionate to the number or quantity of particles; and as their denſity is *greater* as they approach the central particle, it muſt follow, that they will attract each other with a force inverſely proportionate, to their diſtances from their reſpective centres;

tres; the nearer they are to thoſe centres, the greater their force of attraction to each other; in the ſame manner, as two bodies electrified, the one with poſitive, the other negative electricity: or the north and ſouth poles of two magnetic needles, attract each other with a force, increaſing in a certain ratio, as their diſtance decreaſes.

The attraction of arrangement to a *certain extent*, around a *fixed* particle, will *exceed* the attraction of union with the other kind of active particles; unleſs they are in an *equal* ſtate of excitement; in which caſe, they will attract each other, ſo as to draw their reſpective centres into contact, without being able to ſeparate from them.

If particles of æther, for inſtance, be *ſtrongly* excited to arrangement, they will form no union, even with particles of phlogiſton, *ſlightly* excited; becauſe their attraction to *each other*, in that ſtate of *nearneſs* to their exciting centre, exceeds the force of the attraction of union, which the *ſlightly* excited particles of phlogiſton, in that ſtate, are capable of exerting.

In conſequence of the ſuperior force of the attraction between the two fluids, to that by which ſimilar particles arrange themſelves to each other, when extending beyond a certain diſtance from the exciting centre, it will follow, that, if a central particle be ſurrounded by an atmoſphere of æther for inſtance, of that *certain extent*: that *ætherial* atmoſphere, will rather unite to a *diſengaged phlogiſton*, than extend itſelf, by taking into arrangement, a greater quantity of *æther*; but thoſe *Phlogiſtic* particles, having no previous excitement or atmoſpheric arrangement, of particles, will be ſimply attracted *to*, and united *with* the *external* particles of the ætherial atmoſphere; and in conſequence of that attraction becoming *excited*, they will take their uſual form of *arrangement* amongſt themſelves, and form an *atmoſphere* of *phlogiſtic* particles, whoſe centre, is an *atmoſphere* of *æther*, excited by its central particle of *fixed* matter. In like manner a *phlogiſtic* atmoſphere of a *certain* extent, around its original particle, may have an *external* atmoſphere of *æther*.

If theſe *two different compound* particles, be brought into contact, the *external* atmoſpheres being different, will attract and approach each other: till, by approximation the *internal* atmoſpheres are brought into contact; they being *different*, will penetrate, unite with, and ſatisfy *each other;* in conſequence of which, they will *loſe* their attraction for their reſpective *external* atmoſpheres, which will therefore unite, and *ſeparate* from the other compound; and that union, more or leſs perfect, according to the degree of excitement they reſpectively had, or acquire, by the circumſtances which effected their union, will produce a *compound active* fluid, or fluids, differing in their properties, as the *degree* of excitement, or *intimacy* of the union, between the particles of the two active fluids of which they are compoſed, ſhall differ; ſuch are *Fire* and *Light*.

Having now taken a progeſſive view, of the *ſimple principles*, or *elements*, of which the univerſe is compoſed; their *properties*, and the *general laws*, by which thoſe principles are governed or actuated; I ſhall take the liberty to recapitulate, or give the following conciſe view of the whole.

1. Nothing can *act* or produce *effects,* which does not *exiſt* as a cauſe.

2. Nothing can act at a *diſtance* from itſelf, becauſe nothing can act *where it is not*.

3. Every thing in nature is produced by *matter*, and *attraction*, when particles of matter are in *contact*; for unleſs they be in contact, no body, or ſubſtance can act upon another; therefore attraction, or repulſion, at a diſtance from the acting body, can *not* exiſt, becauſe they imply a power by which matter acts where it is not.

4. There are in nature a number of *ſolid*, *points*, *atoms*, or *particles*: diveſted of every property but attraction, and impenetrability, theſe I have called *fixed* particles of matter.

5. There are *other* particles of impenetrable matter, which when attracted by the former, become excited to arrange themſelves in right lines, ſo as to form an atmoſphere of radii diverging

from the *fixed* particle as a centre; theſe I call *active* particles.

6. Theſe active particles *only* become excited, ſo as to exert or ſhew their attractive power, when they have an opportunity of uniting with *fixed* particles; or with other particles rendered active, by being united to fixed particles, as centres.

7. When active particles of matter are excited, by a particle of *fixed* matter, they then attract *other* particles of the *ſame* kind of active matter: which therefore become excited; and by a peculiar *polarity* or property, arrange themſelves in right lines, ſurrounding the fixed particle like an atmoſphere.

8. Excited atmoſpheres of active particles forming lines like rays round their exciting central particles, the further they recede from thoſe centres, the leſs will be their excitement, and the greater their diſtance from each other.

9. The active particles of matter are of *two* kinds, ſimilar in their becoming excited by the attraction of fixed matter: and in their polarity, or property of their particles arranging themſelves in right lines, in conſequence of that excitement. To theſe *two active* matters, I give the names of *æther* and *phlogiſton*: æther being an active fluid, adopted by Philoſophers, but overlooked by Chemiſts; and phlogiſton an active matter, adopted by Chemiſts, but neglected by Philoſophers.

10. Theſe *two* kinds of active matter, when excited, beſides their attraction to fixed matter, and attraction of arrangement amongſt themſelves, have a powerful attraction *mutually* to each other, when in ſimilar ſtates, or degrees of excitement.

11. When a *fixed* particle of matter, is *once* ſurrounded by an atmoſphere of *æther*, they can never more be entirely ſeparated. The *fixed* particle attracting no other matter more powerfully than æther; and æther, being attracted by nothing more forcibly, than the fixed particle it already ſurrounds. And this union forms a parti-

cle of *earth; one* of the *fixed,* though ſecondary or *compound principles* of nature.

12. A particle of fixed matter, invcloped by an atmoſphere of *phlogiſton,* can never be entirely ſeparated; and that union forms, the *other fixed,* but *ſecondary* or *compound principle* of nature, the *acidifying principle.*

13. Atmoſpheres of *ſimilar* kinds of active particles, cannot penetrate, or unite; but when in contact, will *preſs* upon and *reſiſt* each other.

14. But, atmoſpheres of the *two different* kinds, in a *ſimilar* ſtate of excitement, will attract each other; and by that means *draw* their reſpective exciting centres into *contact.*

15. A particle of the *earthy* principle, being compoſed of a fixed particle of matter, with an *ætherial* atmoſphere, that æther will at a certain diſtance from its exciting centre, attract the particles of *phlogiſton,* rather than thoſe of æther; when by being attracted to the ſurface of the *ætherial* atmoſphere,

moſphere, the particles of *phlogiſton* become excited, and arrange themſelves in an *atmoſpheric* form around the *other*. And in the ſame manner, a particle of the *acidifying* principle, will attract and be ſurrounded by an *atmoſphere* of *ether*. *Each* of theſe fixed principles, by means of theſe *external* atmoſpheres, acquiring properties, different from what they poſſeſs in their ſimple ſtates.

16. An active *atmoſphere*, to a certain extent around its *fixed centre*, is inſeparable; it will therefore only attract an atmoſphere of the *other* kind, in a ſimilar ſtate, ſo as to form the *attraction* of *coheſion*: by which, the *two* particles or *fixed* principles, or centres, will be forcibly drawn and kept together.

17. But an *external* atmoſphere of *one* kind, meeting with an *external* atmoſphere of the *other*, will unite, and by drawing their reſpective *actuated centres* into *contact*, will become *diſengaged*, by the attraction of the internal actuated particles, *ſatisfying each other*.

18. If a particle of the *earthy* principle, ſurrounded by an *external*, or *phlogiſtic* atmoſphere, be brought into contact with a particle of the *acidifying* principle, ſurrounded by an *external ætherial* atmoſphere: the attraction between the two external atmoſpheres, will cauſe them to penetrate each other, and unite ſo far, that the *internal* atmoſpheres, *eſſential* to the *earthy* and *acidifying* principles, will come into contact; when, they being of the *two different* fluids, will attract *each other*, and unite alſo: forming a ſolid *compound*, different from either earth or acid; in conſequence of which union, the two *internal*, or *eſſential* atmoſpheres, being ſatisfied with each other, *loſe* their attraction to the *external* atmoſpheres intirely; which therefore will *unite*, and *ſeparate*, in a form different from either of the *ſimple* active fluids, as being compoſed of *both*; and the *ſame* two fluids, under different circumſtances, where the *mode*, the *violence* of excitement, or *intimacy* of union is different, will produce compounds of different properties; ſuch are *Fire* and *Light*.

19. No *external* atmoſphere, can *ſeparate* from

its exciting *fixed* principle as a centre, unleſs it can meet with the *other* kind of active matter with which to combine: at the ſame time, that the *centre* from which it ſeparates, can attract *its oppoſite principle*, to ſupply the place of the diſengaged atmoſphere.

20. An atmoſphere of *either* kind, *ſlightly* excited, by a ſurface with which it cannot *intimately* unite, will readily *ſeparate*, to unite with the *oppoſite* active fluid in a ſimilar ſtate; which will *ſeparate* alſo; and eſcape *combined* with the *former*, in the form of an active ſenſible fluid.

Having now delivered my *general Explanation* of the *elementary Principles* of Nature, and the *laws* by which they are governed; I ſhall next endeavour to demonſtrate their actual exiſtence, and point them out, ſo that they may be certainly known and readily diſtinguiſhed from each other.

SECTION II.

An Attempt to prove, that the Elementary Principles, propoſed in the preceding Section, in reality exiſt; and to point them out in Nature, ſo that they may be known, and diſtinguiſhed from each other with certainty.

ALL the ſolid bodies or ſubſtances in nature, when chemically examined, are found to have *ſolid* baſes of particles, which are either *Earthy* or *Acid.*

An *alkali* and *earth*, in the moſt perfect ſtate of purity in which we can procure them, ſo nearly reſemble each other in their leading properties, that we may ſuppoſe them to be the *ſame* principle, more or leſs combined with ſome *other* principle or principles: however to deviate as little as poſſible from the common mode of expreſſion, and to avoid prolixity, I ſhall claſs them *both* under the ſame general title, the *earthy principle;* rather than under that of alkali, or the principle of alkalinity.

To ennumerate the *diſtinguiſhing* properties of acids, and earths, would be ſuperfluous; their exiſtence is univerſally allowed, therefore I need not ſpend time in proving what is already granted. All I ſhall further add at preſent, by way of explaining my ideas of an acid and earth, is, that an *acid* particle is known by its taſte, and other properties, to Chemiſts and Philoſophers; and that the baſis of *every* ſolid, liquid, or aeriform ſubſtance in nature, which is not formed of thoſe *acidifying* particles, is compoſed with an *earthy* baſe; or with the particles of the earthy and acidifying principles, combined in certain proportions.

The acidifying particles form one fixed principle therefore, and the earthy the other; *ſimilar* in the properties of ſolidity, fixity, or ſubſtantiality; and in their *mutual* attraction to each other; but *different* in their other properties and affinities.

An earth and acid being granted, as the *two* principles, as baſes, giving ſolidity to all bodies, I ſhall next proceed to conſider, and point out the other two principles.

If a certain quantity of *phoſphorus*, be confined in a ſufficient quantity of *pure air*, *light* and *heat* will be produced: the *volume* of air will be *abſorbed*: and a quantity of *acid* will remain, *exceeding* the original weight of the phoſphorus employed. It is certain therefore, that the *additional* acid, was furniſhed by the *air*. But thoſe additional particles of acid, when in their *aeriform* ſtate, could *not* be in *contact*; becauſe they then occupied a ſpace vaſtly *greater*, than that which they now poſſeſs,

poſſeſs; but as no particle of matter can act where it is not, 'tis evident, that they could *not puſh* each other to that diſtance: therefore they muſt have been *ſurrounded* by *atmoſpheres* of ſome kind of *active fluid*; *which* atmoſpheres, *preſſing* upon *each other*, kept them aſunder; and *this active* fluid, be it what it may, I call *æther*. But ſince the particles of acid, by combuſtion with phoſphorus, are now *condenſed* into a much more ſolid form, and occupy much *leſs ſpace* than before, in their aeriform ſtate, 'tis evident, that they are *no longer* ſurrounded by their ætherial atmoſpheres. The *æther* muſt therefore have eſcaped. Is it not natural then to ſay, that it paſſed *off* in the form of *light*, or *fire*, which were evidently produced, ſo long as the æther continued to ſeparate from its acid baſe, during the combuſtion of the phoſphorus?

Again, If *mercury* be diſſolved in *nitrous acid*, the *acid* will unite with the *earth* of the mercury, and form a *Calx* or *Metallic ſalt*. This *calx*, is therefore evidently compoſed of the *earth* of the mercury, and the *acid*. Expoſe this calx to the action of fire, in *cloſe* veſſels; the reſult will be, that the *mercury* will recover its metallic ſtate, and the receiver be filled with pure air. What change then hath the mercury undergone?——It hath *loſt* the acid with which it was combined when in the form of calx.——What can have become of that acid?——it muſt be contained in the pure air. It is evident therefore, from this and the preceding obſervation, that the *baſe* of *pure* air is an acid.

But the *acid* employed, was not poſſeſſed of *æther*, *ſufficient* to ſurround it in an atmoſpheric form; and the particles of *that* acid, combined with the mercury in a ſolid form, could ſtill *leſs* retain it; from *whence* then, had thoſe ſolid particles of acid, the *æther* ſufficient, to give them their elaſtic form of pure air, by keeping them aſunder? they could acquire it from nothing but the *fire*, neceſſary to the operation. It appears therefore, that *fire* was *produced* by means of æther in the firſt caſe: and that *æther* was furniſhed by the *fire* in this caſe.

But what is this elaſtic, ſubtile fluid, which ſeparates the particles of acid, at ſuch a diſtance from each other, as to give them the rarity, and elaſticity of pure air, and which hath been called æther? Is it fire?—if it be, *every thing* which can give to particles of acid, this *ætherial atmoſphere*, muſt be, or contain in its compoſition, *fire*. It is well known, that *fire* will give this *ætherial* atmoſphere to nitrous acid, when it ſeparates it from the mercury, as hath juſt now been mentioned; that light will give it the *ſame* kind of atmoſphere, if the nitrous acid be expoſed to it, in the ſtate of vapour: and that the *electric* fluid, taken in ſparks or ſhocks through the ſame, will give the ætherial intermedium alſo; in *each* caſe, giving the acid the *ſame* form, and properties, thoſe of pure air. It is evident therefore, that fire, light, and the electric fluid, equally communicate this *ætherial* fluid, to the particles of acid, to give them the form of pure air; and conſequently, that they are either *one* and the *ſame* fluid: or that *this ætherial* fluid, is an *eſſential* conſtituent part, in each.

But if they were one and the ſame fluid, they would have no properties, *different*, the one from the other; but they *have* different properties: therefore, they are fluids of different kinds; and one principle, common to them all, is, this *æther*, which united to the acid principle, forms pure air.

But, if fire, light, and the electric fluid, all contain æther: and having different properties, require *ſome other* principle to be joined with that æther, to give *thoſe* properties, wherein they differ: what becomes of *that other* principle, when the æther ſeparates from it, to unite with and ſurround the particles of acid, when they take the form of pure air?—it muſt unite with the ſubſtance, or matter from which the acid particles ſeparate; and the *change* produced upon metals, or the nitrous acid, being the *ſame* when pure air is produced, by *which ever* of the *three* it is effected, ſhews, that the *other principle*, which they each of them are compoſed of, beſides *æther*, is the *ſame*; that their *different* properties, depend, upon the *mode* or *intimacy* of union, between the æther and the other fluid; and *that other* fluid, we may for the future, diſtinguiſh by the name of *Phlogiſton;* as being an active, elaſtic fluid, *like æther*; to which it hath an affinity; but they differ in their affinities with the other principles; *æther* only attracting the acidifying, and *phlogiſton* the earthy principle.

It appears therefore evident that fire, light and the electric fluid, are compoſed of the *ſame principles:* that thoſe are *æther* and *phlogiſton:* that their different properties depend upon the mode, or intimacy of their union, or their degree of excitement, or both: and that *one* may be *changed* into the *other*, by altering the mode of their union, or the degree of their excitement. Thus, *light* when agitated, confuſed, and obſtructed in its paſſage through an opaque body, is altered in the mode of union between the particles of æther and phlogiſton, compoſing it as light; in conſequence of which, thoſe two principles acquire a nearer, or different mode of union, forming *heat* or *fire*, as is evident from experiments with the burning glaſs. The *electric fluid*, paſſing through a *ſlightly* reſiſting medium, undergoes a change in the ſtate of combination of the external electric particles moſt obſtructed, and forms *light*; but if the reſiſtence be ſtill *greater*, it becomes *fire*, as is evident from its accending gunpowder, melting metals, &c.

'Tis evident therefore, that neither *fire*, *light*, nor the *electric* fluid, can render ſolid particles of earth or acid, permanently elaſtic, but by being decompoſed; and that *that* decompoſition, cannot take place, unleſs each principle when ſeparated, hath *another* principle with which to unite. For if any ſubſtance, or fluid is thrown into the ſtate of vapour, by heat, without decompoſing that heat or fire; ſo ſoon as the particles of that vapour come in contact, with any body poſſeſſed of *leſs* heat: they are robbed of it, and *condenſe* into their *original* fluid or ſolid form.

But, as a further proof of the actual exiſtence of theſe *four* principles; and the veracity of the preceding concluſions, I ſhall bring the following chemical experiment.

If a certain proportion of pure air, and inflammable gas or air, be mixed together, and exploded by any ignited particle of matter; the reſult will be *fire* or *heat*, *light*, and *water*.

Pure air, from the experiments with phoſphorus or calx of mercury, mentioned before, we know for a certainty, contains a number of *acid particles*, which cannot be in contact, and therefore cannot act upon each other; conſequently they muſt be kept aſunder, by ſome *active* fluid, ſurrounding them as *atmoſpheres; this* active fluid, I have called *Æther;* ſo that *pure air* is compoſed of *acid* particles, with ætherial atmoſpheres, ſurrounding and keeping them aſunder. But when this pure air is exploded with inflammable air, the æther is ſeparated, and the acid particles are condenſed: but though the volume of both the airs is loſt, we find no reſiduum of pure diſengaged acid; what then can have become of it? it could not eſcape through the ſides of the glaſs, in which the experiment was made; it muſt therefore be contained in the *Water*. But water is an inſipid, neutral fluid;—yet the *acid* muſt be there; and muſt therefore be combined with *ſomething*, capable of uniting with, and neutralizing it. That *ſomething*, cannot be æther, becauſe with æther, it formed pure air: which ſtate of elaſticity, and rarity, it hath now loſt, by being ſeparated from its æther; it muſt therefore follow, that the *acid* is now combined with the *earthy* principle: with which it is united to ſaturation; for *earth* is the *only* thing, with which the *acid* could be ſaturated, or unite, when deprived of æther.

The *water*, then, produced by this operation, is compoſed of the *acid* particles of the pure air, when ſeparated, at leaſt to a certain degree, from their ætherial atmoſpheres: united to, and ſaturated with, particles of *earth*, retaining but little of their atmoſpheres. But by what was this earth ſupplied? not by the pure air, becauſe it contained only æther and acidifying particles; conſequently, it was procured from the *inflammable* air. Theſe particles of *earth* therefore, formed the *baſe* of the inflammable air. But when in that aeriform ſtate, they occupied a ſpace *much larger*, than *that* they *now* poſſeſs, as forming part of the ſmall reſiduum of water: 'tis certain therefore, that they in their aeriform ſtate were far *ſeparated* from each other: that *that* ſeparation, could not be effected by their action upon each other; matter not acting where it is not; 'tis evident therefore, that they were ſeparated, by the interpoſition of an *active elaſtic* fluid, ſurrounding them like *atmoſpheres*; in the ſame manner, as the particles of *acid* were by æther, when in the form of pure air.

The particles of matter forming the *baſe* of inflammable air, muſt therefore be of the *earthy* principle; and thoſe particles in that *aeriform* ſtate, muſt be kept aſunder by *ſome* active elaſtic fluid; but what is that fluid?——what can it be?——It cannot be æther, or that kind of elaſtic fluid, which ſeparates the particles of the acidifying principle, in pure air; becauſe *that* fluid, *that* æther, hath no affinity with the *earthy* principle; it muſt therefore be an *elaſtic, ſubtile fluid*, poſſeſſed of the ſame attraction to the *earthy*, which æther hath for the acidifying principle; and to diſtinguiſh it in future, let it be called *phlogiſton*.

Inflammable air then, is compoſed of particles of the *earthy principle*, ſurrounded by *atmoſpheres* of *phlogiſton; pure* air of particles of the *acidifying* principle, ſurrounded by *æther;* theſe when mixed together, and exploded, produce *fire* and *light:* at the ſame time that they *loſe* their elaſtic, expanded form: and the reſiduum is *water*. Water muſt therefore, be compoſed, of the *ſolid baſes*, or particles, of the *two airs;* the *acid* and *earthy* particles; which uniting, ſaturate each other, and form *that* neutral compound; at the ſame time, the *two* diſengaged elaſtic fluids, the *æther* of the pure air, and *phlogiſton* of the inflammable, unite, and form *fire*, or *light;* according to the circumſtances, to which *different* parts, of the two fluids, are expoſed, during their combination.

From the experiments, and obſervations, univerſally allowed, and eſtabliſhed, which are recited in the preceding pages, 'tis impoſſible to deny, that *pure air*, contains the *principle* of *acidity*, or *acidifying* particles, as its baſe: that thoſe *acidifying* particles, enter into the compoſition of the *water*, produced by exploding *pure* air with *inflammable gas:* that in *that* ſtate, they ſhew no ſigns of *acidity*, and are therefore neutralized: that the *only* ſolid, or liquid matter, capable of neutralizing an acid, is of an *alkaline* or *earthy* nature: conſequently, that thoſe particles of *acid*, are neutralized by being united with an *earthy* matter: and that *that earth*, was furniſhed by the *inflammable Gas*. Theſe facts being proved, it muſt follow, that before any one can diſprove the exiſtence of the *two active* fluids, neceſſary to give theſe *ſolid* particles, the *elaſtic*, *expanded* form of air: he muſt *firſt* of all, demonſtrate, that *matter can*, and *does* act where it is not; or that *one* particle of matter, can act upon *another*, at *a diſtance* from itſelf, without *any intermedium*. That it *can*, is not poſſible to be conceived, and therefore ought not to be aſſerted, or permitted; and that it *does*, there is not one decided proof, and therefore I utterly deny it.

If then matter cannot *per ſe*, act where it is not:—the *particles* of the *acidifying* principle, entering into the compoſition of the *water*, produced in the preceding experiment, when *expanded* in the form of *pure air*, could not be in contact; and conſequently, muſt have been kept aſunder, by the interpoſition of *ſome other active*, ſubtile, elaſtic fluid; and the particles of *earth*, when expanded in the form of *inflammable* gas, muſt have been kept ſeparate, by a *ſimilar* kind of active fluid. That theſe fluids are *different*, is evident from their different properties: from their attraction for, and union with each other: from *that* union producing compounds, poſſeſſed of different properties, according to the intimacy or mode of combination, the degree of their excitement, or different proportions: and from each having an affinity to *one* ſolid principle, and total inability to unite with the other. Indeed, theſe *two active* principles, are poſſeſſed of *ſimilar* properties, to what the two *paſſive* principles have. The *acidifying*, and *earthy* principles, will unite, and form a compound, different from either; ſo will the *two active* principles. The acidifying principle will unite with *one* active principle, but *not* the *other*; ſo will *that other* unite with the earthy, but not with the acidifying principle. *That* active principle therefore, which will unite with the *acidifying* principle, I call invariably by the name of *Æther*;

and the *other* active fluid, capable of uniting with the *earthy* principle, is as conſtantly diſtinguiſhed by the name of *Phlogiſton*.

Again, let us *ſuppoſe*, that every aeriform fluid, owes its elaſtic, expanded form, *to fire*, or that principle which in action produces, the ſenſation of heat; and conſequently, that *fire* is an element, or ſimple principle, capable of uniting with ſimple particles of matter, and by removing them to a diſtance from each other, of giving them the form of elaſtic fluids.

Suppoſe this ſimple element of *fire*, the *only agent* in nature, capable of giving the aeriform ſtate to ſolid particles; for to ſuppoſe *another*, is much the ſame, as to allow the principles for which I contend.

Pure air then, being proved to contain an *acid*, will be compoſed of a number of acid particles, ſeparated from each other, by being united to the ſimple element, of *fire*. Mercury then, may be *ſuppoſed* a ſimple ſubſtance, as the *Antiphlogiſtians* pretend; and this *mercury*, by means of *fire*, will attract the *acid* baſe of the pure air, and form a calx. But in this operation does the mercury abſorb the pure air, that is the *acid* and *fire* entire, or only the acid?—*Suppoſe* we ſay that it only unites with the *acid*, or oxygenous baſe; the *fire* then muſt become *disengaged*, and eſcape in its proper form of fire. 'Tis evident therefore, that the mercury when heated, hath a *greater* affinity to the *acid* principle, than *fire* hath.

But, if this calx, or mercury combined with the acid principle, be heated by itſelf, in cloſe veſſels, preventing any foreign communication, the fire will attract the *acid* from the mercury, and take the form of pure air; while the mercury regaining its metallic ſtate, will remain ſimple, and pure behind. 'Tis evident in this caſe that *fire*, hath a *greater* affinity to the *acid principle*, than heated mercury hath; becauſe, it will take it *from* it. But the *firſt* operation proved, that *mercury* had a *greater* attraction to acid, than *fire* hath; therefore, theſe *two oppoſite* concluſions, ſhew, that *theſe* principles are *inſufficient* and *unphiloſophical*.

Suppoſe then, that mercury attracts the air *entire*, that is, both the *acid* or oxygenous baſe, and the *fire* which gives it the form of air. We muſt then ſay, that *mercury* when heated, attracts the *acid principle*, and the *fire*, neceſſary to give it the form of pure air, alſo, by which union it becomes a *calx*, or compound of *mercury*, *acid* and *fire*. If this compound be cut off, from every external communication, and heated, the acid principle with the fire will ſeparate, in the form of pure air; and the ſimple mercury will remain, having recovered its metallic properties.

'Tis evident therefore, that *mercury*, when heated, *loſes* its attraction to pure air, or a compound of *acid* and *fire*. But the former operation was to prove, that mercury when heated *acquired* the power of attracting pure air; therefore 'tis plain that the opinion of *mercury* being a *ſimple* or *uncompounded* ſubſtance, and *pure air* a compound of the *acid* or oxygenous principle and *fire*, and *that fire* a *ſimple* ſubſtance alſo, is puerile, and *unphiloſophical*.

'Tis evident, that mercury, when *ſlowly heated*, will attract the *acid baſis* of pure air, from its elaſtic meduim; but when *violently* heated, it cannot retain that acid in combination; for which reaſon alſo mercury, when violently heated will ſublime, or evaporate without decompoſition, or becoming a calx.

But if mercury be a *ſimple* ſubſtance, and pure air a compound of *acid* particles and *fire*, the *quantity* of fire thrown into the mercury, *cannot* make any difference, in the *attraction* between the *mercury* and *acid principle*, no more than the quantity of water, combined with an *alkali*, can alter the attraction between thoſe alkaline particles, and the particles of acid combined with water; we muſt therefore of *neceſſity*, have recourſe to ſome other mode of explanation.

Pure air *alone*, we know is unchangeable in any degree of heat; ſo is mercury. But mercury *without* heat, will *not* decompoſe pure air; with a *certain* degree of heat, it *will* decompoſe it, by attracting its acid: but in a *greater* degree of heat, will *loſe that attraction* for the acid, and *part* with it. But *heat*, can produce *no change* in *ſimple* bodies, but that of *expanſion*. An *alkali*, *always* retains its alkaline properties, *howſoever heated*; and an *acid* is *always* an acid, in *every* degree of heat. However, 'tis evident that the acid baſe of the air, hath *ſometimes* a *greater* attraction for mercury, than for its elaſtic principle, and in a *greater* or *leſs* degree of heat, it hath a ſtronger attraction to the *fluid* which gives it its *aeriform* ſtate, than to mercury. But the attraction of the *acid* to its *elaſtic* fluid being *always* the *ſame*: and its affinity to *mercury* being *always* the *ſame*, it muſt follow, that *when* the mercury will *not* unite with the acid, ſome *change* muſt have taken place in the mercury; that change *cannot* be the *loſs* of its *affinity* to the acid, becauſe original natural properties, are *unalterable* by heat; therefore, its *inability* to unite with the acid principle, muſt be owing to its attraction *to*, and union *with ſome other principle*, which in *thoſe circumſtances*, it hath a *greater* affinity with, than it hath for the acid principle.

Mercury muſt therefore be a *compound*; and the affinity of its *baſe* with the *acidifying* principle, and its appearance when calcined, prove, that *that* baſe is an *earth*, as hath been univerſally allowed.

Mercury then is an *earth*, united to ſome *other* principle; and pure air is an *acid*, combined with *another* principle. Are thoſe two principles the *ſame?* are they *both Fire?* or are they *different* principles, which by their union when diſengaged, from their reſpective baſes of Earth and Acid, produce *Fire?*

Let us for a moment *ſuppoſe*, that *both* theſe principles, are the *ſame*, and that *that* principle is *fire*; and conſequently a fluid, ſimple and uncompounded.

Mercury will then be an *earth* united to *fire*, and pure air, an *acid* combined with the *ſame* active principle, *fire*.

By the operation of *calcination*, 'tis proved that the *earth* of the mercury, will *quit* its *fire*, to combine with the acid of the air when heated together;

but when this *calx* or compound of earth and acid, is ſufficiently expanded by means of heat, the earth quits the acid, *regains* its fire, and becomes mercury; while the acid alſo recovers it priſtine ſtate, that of pure air; therefore at *one time* the *attraction* of acid to earth, is *greater* than their *united* attraction to *fire*; and at *another time* their *attraction* to *fire*, *exceeds* the *affinity* with *each other*; conſequently, the idea of mercury being an *earth* united to *fire*, as a principle, upon which its metallic properties depend, muſt be erroneous. But it hath been proved, that mercury ſuppoſed to be a *ſimple* ſubſtance, is alſo inſufficient, and falſe: therefore, it muſt follow, that *mercury* is an *earth*, *combined* with *ſome active principle*, *different* from *fire*; and that *that* principle, may be called by the name of *phlogiſton*, by way of diſtinction, rather than by any other name; becauſe it is a principle, whoſe exiſtence in mercury, hath been *long* admitted, and *never* diſproved.

We are certain then, that mercury contains an *earth*, united to an active principle called *Phlogiſton*; which phlogiſton is not *fire*, but a ſomething proved to be very *different* from it; and we are equally certain, that pure air is compoſed of an *acidifying* baſe, combined with *ſome* kind of elaſtic fluid.

What is this elaſtic fluid, which gives the particles of the *acidifying* principle their aeriform ſtate?—is it *phlogiſton?*—no——it cannot; for if mercury were *earth* and *phlogiſton*, and pure air *acid* and *phlogiſton*, the ſame inconſiſtency would ariſe, as was the caſe when *fire* was ſuppoſed united to each in the place of phlogiſton: that is, *ſometimes* the earth and acid, would have a greater attraction for *each other*, than for phlogiſton; and at *others*, they would attract *phlogiſton* with more force than each other; which being *oppoſite* effects, ariſing from the *ſame* cauſes, declare the ſuppoſition at once to be falſe.

Let us ſuppoſe then, that it is *fire*, a *ſimple principle*, which gives the particles of *acid* the form of *pure air*. We ſhall then have mercury, an *earth* united to *phlogiſton*; and pure air an *acid*, combined with *fire*.

'Tis evident then, that in the *degree* of *heat*, *neceſſary for calcination*, the *acid* of the pure air, muſt have ſo *great* an attraction to the *earth* of the mercury, that it will *part* with its *fire*, and diſplace the phlogiſton from the mercurial earth. But during the *reduction* of the mercury, the *acid* hath ſo *powerful* an attraction to *fire*, that it will *ſeparate* from the *earth*, to unite with it. This is inconſiſtent. Or *ſuppoſe* we ſay, that the *united* attractions between the earth and acid, and the phlogiſton and fire, *exceed* the attractions of the earth to the phlogiſton, and the acid to the fire, with which they are now combined; in conſequence of which, a *double* decompoſition takes place, and *two new* compounds are produced: the earth and acid combine and form a *calx;* and the diſengaged *fire* and *phlogiſton* unite, and eſcape in the form of what? ——not fire—becauſe, the compound is fire and phlogiſton——what then?——ſay any thing—ſay *light* for inſtance.

If this compound of earth and acid, then, be expoſed to the action of fire in cloſe veſſels, the attractions of the acid to fire, and of the earth to phlogiſton, will now *exceed* the attractions of earth to acid, and fire to phlogiſton, *which* were the *moſt* powerful in the former caſe; in conſequence of which, the acid and fire will again become pure air, and the earth and phlogiſton, mercury. But if *fire* be a *ſimple* ſubſtance, whence had the earth its *phlogiſton*, ſo as to become mercury? —— to avoid this difficulty, we will ſay that the degree of heat, or fire neceſſary to the operation, was accompanied with *light*, which furniſhed the phlogiſton——at preſent be it ſo, ſtill the facts *contradict* each other, admitting thoſe principles: therefore *thoſe* principles are *falſe*, which make *pure air* a *compound* of *acid* and *fire*. For the earth and phlogiſton of mercury, being unalterable principles, in every ſituation poſſeſſed of the *ſame* properties; and the *acidifying* principle of pure air, being poſſeſſed of certain properties, by *no means* deſtructible: it muſt follow, that if the *acidifying principle* hath a *greater* attraction to earth, than to *fire* at *one* time it muſt at *all* times; and conſequently, ſince it will at *one* time *quit* its elaſtic fluid, to unite with the *earth* of the mercury; and at *another*, will quit the earth to reunite with its *elaſtic fluid*, 'tis evident, that *that elaſtic fluid*, is *not fire*, but *ſome other* principle: which is *more*, or *leſs intimately* combined with its *acidifying baſe*, as it contains *leſs* or *more* of the matter of *fire* in its *interſtices*; that when *intimately* united to its baſe, it will attract *that* acidifying baſe *more* forcibly, than the *earthy* particles, united to their phlogiſton will; but when the quantity of fire penetrating it, is *ſo great* as to ſeparate it at a greater diſtance *from*, or weaken its attraction *to* its baſe: and the phlogiſton of the earth is in the *ſame ſtate*, by the *ſame means*: its attraction then becomes *greater* for the *phlogiſton* of the earth: and the attraction of its *acid* becomes alſo *greater* to *that earth*; in conſequence of which, this *elaſtic* fluid of the pure air, well *unite* with that *phlogiſton*, and form *fire* or *light*, or *both*; and the acid and earth, will *combine* and form a *calx*.

'Tis evident therefore, that the *fluid* which gives the particles of the *acidifying* principle, the form of pure air, *cannot* be *fire*; and from the preceding reaſons, 'tis equally certain, that it cannot be *phlogiſton*; but it *muſt be*, and *is*, *ſomething*; and that *ſomething* ought to have a *name:* and *that name* may be what you pleaſe; only preſerve the idea of a *ſubtile elaſtic fluid,* capable of *uniting* with the *principle* of *acidity,* and forming an *aeriform fluid,* which is able to ſupport the combuſtion of *inflammable matter,* and the reſpiration of animals: and of uniting with *phlogiſton,* when ſeparated by heat, from the ſubſtances which contain it, and forming *light* or *fire.* That this fluid, may not want a name to diſtinguiſh it by, I have ventured to call it *æther,* 'till ſome one ſhall find a *better;* and give *ſufficient reaſons* for the change.

Having therefore been under an abſolute neceſſity, of admitting and adopting *two different active,* or *ſubtile elaſtic fluids,* and an *acidfying* and an *earthy principle:* let us apply them, to the explanation, of the very operations, which could not be *conſiſtently* accounted for, by *any other theory,* and with *any other principles,* different from theſe.

Mercury is compoſed of the earthy principle, intimately combined with *phlogiſton;* pure air of the *acidifying principle*, united to *æther*. In this ſtate, in the *common temperature* of the air, they have no ſenſible action upon each other; which ſhews, that phlogiſton hath a *greater* affinity with the earthy principle, when cloſely united with it, than with æther when combined with the acidifying principle. But if the degree of heat neceſſary to promote combuſtion, or calcination, be applied, that *fire* will *penetrate every* part of the mercury, and pure air: by which the active principle in each, will be *expanded*, and conſequently leſs forcibly attracted, and detained by its baſe, or fixed centre. The æther and phlogiſton being therefore more at liberty, their attraction to each other, will become *greater*, than their power of attraction to their *reſpective baſes*; therefore they will penetrate and unite into *attractive lines* of *particles*, *drawing* their reſpective baſes into *contact*; thoſe ſolid baſes will attract each other, and unite, ſo as to form a *calx*; and by their union the two active fluids will be *diſengaged*, *combine*, and form *fire* or *light*, in which ſtate they will eſcape.

If this calx be expoſed to a ſtill *greater* degree of heat, in cloſe veſſels, preventing every external communication with the air, and the volatilization and diſperſion of the calx: the quantity of fire now employed, will inſinuate itſelf ſo *copiouſly*, into every part, and between every particle, as to *ſeparate* the particles of *earth* and *acid*; by which ſeparation, or diſunion, they can *no longer* attract each other. But though their union is broken, by the interpoſing fire, their properties of attraction are not altered or diminiſhed: therefore, as they cannot in ſo violent a degree of heat, *unite* with *each other*: *each* will attract its *proper active principle*, by *decompoſing* a part of *the fire*; the earth will unite with phlogiſton, and form mercury; and the acid with the æther, and produce pure air.

The æther of pure air therefore, will *never quit* its acid, to unite with the phlogiſton of mercury, but when the *quantity* of fire employed, is *ſo great* as to ſeparate the phlogiſton and æther from their baſes, or expand them ſo much as to render their attractions for their reſpective *baſes*, *leſs* than their affinity for *each other*; but *not* ſo *great* as to keep the *earth* and *acid* from *uniting*, by its interpoſition.

For if the earth and acid cannot unite, on account of the quantity of heat interpoſed, they will never ſeparate from their active principles; for that decompoſition can *never* take place, but when the *united* attractions of the æther to phlogiſton, and the earth to the acid, *exceed* the *united* force of the attractions of æther to its acid, and earth to phlogiſton; which never can happen, but when the *degree* of *heat*, by rarifying the active principles, *weakens* their union to their reſpective baſes, by *expandiug* them: without being ſo copious, or great, as to *prevent* the union of the earthy and acidifying principles.

I have ſaid, that æther, and phlogiſton, eſcape in the form of *fire*, or *light*; and that by uniting, they form *one*, or the *other*, or *both*, according to circumſtances; and every operation where fire and light are concerned, tends to corroborate it, and no one inſtance offers to diſprove it.

Mercury hath been proved to contain phlogiſton; and *all* inflammable matters, are capable of furniſhing *phlogiſton* to its calx, ſo as to revive it; 'tis evident therefore, that *inflammable* or *combuſtible* ſubſtances, contain *phlogiſton*. When this phlogiſton is weakened in its union to its baſe, by a ſufficient degree of heat, if in contact with pure air, it burns: a great quantity of *fire* and *light* are produced: and at the ſame time, the air *loſes* its bulk, its æther, and the inflammable ſubſtance its phlogiſton; the acidifying and earthy particles, remaining *entire* in the reſiduum; or elſe forming water, by the heat rarified into vapour, and in that ſtate paſſing away, if in the open air. The fire and light, muſt therefore be produced, by the union of æther and phlogiſton.

Again, the earth of mercury, and the acid forming a calx, when ſeparated by heat, ſo as to be no longer able to attract, and remain united with each other, *decompoſe* part of the *fire* itſelf, as already mentioned; the earth acquiring phlogiſton, and the acid æther; therefore, the *fire* ſupplied both the *phlogiſton* and *æther*: and conſequently, was compoſed of them.

The calx of Gold, or Silver, is compoſed of *earth*, and the *acid* principle. By being expoſed to the action of *light*, the earth regains its *phlogiſton*, and becomes Gold, or Silver, at the ſame time that the *acid* acquires *æther*, and becomes pure air; conſequently, *light* furniſhed *phlogiſton* to the one, and *æther* to the other, by its decompoſition; and muſt therefore be compoſed of *thoſe two principles*. And if *pure nitrous acid* be expoſed to the *light*, in a phial which it does not fill: a quantity of pure air is produced, and the acid becomes phlogiſticated, which again proves, that *light* is compoſed of *æther* and *phlogiſton*, becauſe it gives *æther* to the acid now in the ſtate of pure air, and *phlogiſton* to the reſiduum.

If a number of *rays* of *light* be collected into a *focus*, by means of a concave mirrour, or convex lens, in a *tranſparent* medium, through which they can paſs undiſturbed: the light paſſes through it, unaltered; but, if *that focus* of condenſed light, be thrown upon an *opaque* body, through which it cannot paſs readily, and undiſturbed: the confuſion and condenſation, ariſing from the reſiſtance of the opaque body, and their velocity together, *alter* the *mode* of combination, of the two component principles, of the light, the *æther* and *phlogiſton*; in conſequence of which, they are mixed together, and form a cloſer or *different* union, producing *fire*. This *fire* muſt be produced by the *obſtructed particles* of *light*: therefore, *light* and *fire* muſt be compoſed of the *ſame principles*, in a *different mode* of *combination*.

If an opaque body, be ſuſpended in *vacuo*, in a glaſs receiver, and *light* be thrown upon it in a *focus*, or condenſed ſtate: the quantity of *heat* or *fire* produced, will be *intenſely great*, though the *opaque body*, ſuffers *no change* in its principles, or no *decompoſition*; therefore *this fire*, *muſt* be produced by the *light*, condenſed, confuſed, and violently agitated, ſo as to *loſe* its *natural* combination, or ſtate of exiſtence; and not in the leaſt, by the opaque body, which produces that change by its *reſiſtance*; and *this fire* muſt be compoſed, of *æther* and *phlogiſton*, becauſe all fire is ſo: as hath been proved by its reducing the *calx* of mercury, and producing pure air with the acid; and becauſe it

is

is produced from condenſed and obſtructed *light*, which light is known to be compoſed of æther and phlogiſton, becauſe it will give the *latter* to the *earth* of *Gold:* and the *former* to the *acid* ſeparated from that earth, when it is revived, by uniting with phlogiſton. And conſequently, ſince *fire* is produced by the intimate combination, of the *æther*, and *phlogiſton* of *light*: the heat or *fire* produced during *combuſtion*, is produced, by the *ſame* means, the union of the *æther* of the pure air, with the *phlogiſton* of the inflammable ſubſtance; *both* being *diſengaged* by that operation, *muſt unite*: and that union, will always produce the *ſame* compound, with the *ſame* kind, or degree of excitement, and *intimacy* of union; a violent excitement, and intimate union, will always produce *fire*; but if the diſengaged æther, and phlogiſton, combine *leſs* intimately or with *leſs* force, or in a different manner, they will produce *light*; which *light*, may again be changed into *fire*, if it hath *velocity enough* when it meets with reſiſtence, and is thrown into confuſion, to produce motion, or excitement ſufficient, to take the union, which is neceſſary to change it into fire.

The doctrine of *latent* or *abſolute heat*, which accounts for *every* production of ſenſible heat, by ſome change, in the capacities, of the bodies giving out this ſenſible heat, muſt therefore be *falſe*.

That *ſome* ſolids, and fluids, have a *greater attraction* for heat, and have a *greater capacity* for containing it than others, is undoubtedly true; and that theſe when they *alter* their form, ſtate, or modes of combination, will either require *more heat*, or *give out* part of that they were before poſſeſſed of, accordingly as their *capacities* are altered by this change, is alſo true; and conſequently, that *ſome ſenſible* heat, will be produced, when that capacity for containing it is *diminiſhed*. But this is by no means a proof, that *all ſenſible heat* is produced by that *change* of *capacity*; and that it is not ſo, the *condenſation* of *light*, *moſt abundantly proves*. For an *opaque body*, in *vacuo*, by means of a *focus* of *condenſed ſolar light*, may be *intenſely heated*, without ſuffering any *change* in its *capacity*, or any *decompoſition* of its *principles*; conſequently, the *heat muſt* be *produced*, by the particles of *light*; the principles of which they are compoſed, in conſequence of the reſiſtence of the opaque body, acquiring a different, or more violent, or intimate combination, and thus producing *fire*, or the *matter* of *heat*.

'Tis evident therefore, that light and fire are compoſed of the *ſame principles*: that thoſe principles are *æther* and *phlogiſton*: and that æther and phlogiſton, when *ſeparated* from their reſpective baſes by means of heat, always form by their union, light or fire.

But there is *another* active fluid, *very different* from *either* of theſe, in its properties as a fluid; that is, the *electric fluid*, whoſe production and properties, come next under conſideration.

Glaſs, is a ſubſtance, which in no chemical operation whatever, gives any ſigns of its containing *phlogiſton*. *Sulphur* is a matter, which evidently contains a *great quantity* of phlogiſton: therefore Glaſs and Sulphur, are *two* ſubſtances, *very different* fromeach other.

If a tube of *Glaſs*, be excited by *friction*, it acquires an *electric atmoſphere*; and if *two light* bodies be ſuſpended near it, by filaments of ſilk, they will be *attracted* to it: and acquiring *ſimilar electric atmoſpheres*, will *recede* from it; 'till the *ſurfaces* of the atmoſphere ſurrounding the *tube*, and *thoſe* of the *light* bodies, only touch each other; and ſo long as the electric fluid retains its excitement, around theſe reſpective centres; ſo long will *thoſe atmoſpheres*, prevent the light bodies from approaching near to the tube or each other.

If a ſtick, or globe of *ſulphur* be excited, by friction, it will acquire, in like manner, an *electric atmoſphere*; which will attract *light bodies*, of a ſimilar kind, and ſuſpended in the ſame manner as the former; in conſequencc of which, *they* will acquire ſimilar electric atmoſpheres, and recede from the globe, and from each other, in like manner and upon the ſame principles as the former.

If the two light bodies, which acquired their electric atmoſpheres from the *glaſs* tube, be brought near each other: they will *not unite*, but *repel* or *puſh each other* to a diſtance, proportionate to the *extent* of their electric atmoſpheres; which ſhews, that *thoſe* electric atmoſpheres, have *no attraction* for *each other*; but only for the ſolid ſubſtances as centres, round which they take the form of atmoſpheres.

The two light bodies, poſſeſſed of electric atmoſpheres from the excited *ſulphur*, in like manner will *not unite*, or *approach*; thoſe atmoſpheres having no attraction to each other.

But, if the two light bodies, with their electric atmoſpheres, from excited *glaſs*, be brought near the two others, electrified by means of *ſulphur*: they will *ruſh* into *contact*; their atmoſpheres will *unite*: and *that* union, will *deſtroy* every appearance of *electricity*; the light bodies, having now *no* properties, *different* from what they had, previous to their being ſurrounded by atmoſpheres of the electric fluid.

But, if the *electric fluid* were a *ſimple* ſubſtance, or matter: when excited, *ſimilar atmoſpheres*, formed ed around *ſimilar bodies*, as centres, to which they were attracted by excitement, would *always repel* each other; as is the caſe, when the electric fluid is produced by friction, from ſubſtances of *ſimilar chemical* properties, and compoſition. But, the electric fluid produced by means of *glaſs*, will *not repel*, but *forcibly attract* and *combine*, with the electric fluid produced by *ſulphur:* therefore 'tis evident, that the *electric fluid*, is not a *ſimple* ſubſtance, but is *compoſed* of *two principles*, *different* from each other: that *glaſs* will excite *one* of them, to become active, and take an atmoſpheric form, and *ſulphur* the *other:* that in *that form*, *each reſiſts* an atmoſphere *ſimilar* to *itſelf*, and by *preſſure*, keeps it at a *diſtance:* but that *each* will rapidly *unite* with a ſimilar atmoſphere, formed by the *other principle*, to which *it* hath an *attraction*, producing *union*, and a *deſtruction* of thoſe properties, which they have *contrary* to each other, when excited around their reſpective centres.

Electricity being therefore of *two diſtinct kinds*, called improperly poſitive and negative, or more properly vitreous and reſinous, muſt be compoſed of *two equally active fluids*, of *different* properties when excited, by friction; *each* having the property of *arrangement*, in an atmoſpheric form, around its reſpective centre, and an *attraction* to the *other*. *Poſitive* electricity, is always produced by *one* of thoſe active principles, when excited: and *that* particular fluid, is always excited by means of *glaſs*; and *negative* electricity, by the *other*, which is invariably excited by means of *ſulphur*.

The *electric fluid*, is therefore evidently compoſed of *two active principles*; and *thoſe* two principles, are as evidently, no other than *æther* and *phlogiſton*; and conſequently, the electric fluid is compoſed of the *ſame principles*, as fire and light are.

Fire and light, are produced by the combination of æther and phlogiſton, when *ſeparated* from their *reſpective baſes*, by means of heat or fire; but the *electric fluid* is produced whenever *æther* and *phlogiſton* are excited to become *active*, and capable of *ſeparating* from their reſpective exciting bodies,

dies, to *unite* with *each other*, by *any other means*, than *chemical decompoſition* by heat.

That it is compoſed of the *ſame principles* as fire or light, is certain, becauſe when paſſed in ſparks or ſhocks through *nitrous acid* vapour, it affords *æther* to the acid, ſo as to enable it to take the form of pure air; and it communicates *phlogiſton* to the *calces* of metals, ſo as to *revive* them; and becauſe when it meets with a *ſlight* reſiſtence, as in paſſing through air, it changes the *mode* of combination of its principles, and becomes *light*; and when it meets with *ſtill greater* reſiſtence, as in paſſing through gun-powder or the powder of reſin, the reſiſtence of the ſubſtance to its rapid motion, cauſes its principles to unite *ſtill more intimately*, and take the form and properties of *fire*.

But if the *electric* fluid, changes *nitrous acid* into *pure air*, and *revives* metallic *calces*, it *muſt* afford *æther* to *one*, and *phlogiſton* to the *other*; and conſequently, muſt be compoſed of *thoſe two principles*; therefore, it cannot be *different* from fire or light, but in the *mode* of combination, and *intimacy* *cy* of union, which takes place between thoſe *two principles*, when in *thoſe different ſtates*, or forming thoſe *different fluids*; which is fully confirmed, by its being *convertible* either into light or fire, by *different* degrees of reſiſtence, producing a *different ſtate* of *combination*. Indeed, unleſs we allow *two active principles*, or *fluids*, *each* capable by excitement, of aſſuming an *atmoſpheric electric* form, around the bodies excited, or immerſed in that atmoſphere, but having an *affinity* to *each other* in that excited ſtate, *greater* than *to the bodies* they ſurround: 'tis impoſſible to conceive, or explain, why *glaſs* by means of friction, will always produce *poſitive*, and *ſulphur negative electricity*: why atmoſpheres of poſitive or negative electricity, will *not* admit the near *approach* of *ſimilar* atmoſpheres: why an atmoſphere of *negative* electricity, will eagerly or violently *ruſh* into *union*, with another of *poſitive* electricity: or why, by *that* union, every appearance of electricity, whether poſitive, or negative, is *deſtroyed*. *Two active*, *different fluids* therefore, there muſt be, and are, *which*, when excited by friction, produce the phenomena of *electrical attraction* and *repulſion*; and by their *union*, form the *Electric ſhock.* By this violent union, according as circumſtances differ, light or fire, may be produced: the calces of metals may be revived: and the acid principle acquire the properties, and form of pure air.

Theſe two principles therefore, of the electric fluid, are the *ſame,* as *thoſe* compoſing fire or light; and *one* of them uniting with the metallic earth, ſo as to revive it, muſt be *phlogiſton*; and the *other*, combining with the diſengaged acid, and giving it the elaſtic form of pure air, muſt be the *active principle* which I have called *æther.*

Fire, light, and the electric fluid, are therefore evidently compoſed of *two active principles*, diſtinguiſhable from each other, by the names of *Phlogiſton* and *Æther*, as well as by any other; which principles, by the difference of the intimacy or mode of their combination, produce the *three* fluids, of *different* properties, in their *intire* ſtates. *Each* of theſe compound fluids in certain circumſtances, is capable of *decompoſition*, and of *decompoſing* certain other compounds: thus metallic calces,

ces, conſiſting of earth and acid, will decompoſe them: and they the calces. The earth will combine with the *phlogiſton*, and form a metal; and the acid will unite with the *æther* and produce pure air. And *theſe two active principles*, when by interpoſing heat or fire their *intimate* union, or *cloſe* connexion, with their reſpective baſes of earth or acid is prevented, and their attractions to thoſe baſes weakened, will *again unite* and form *fire* or *light*, and leave the acid to combine with the Earth.

Thus have I propoſed the *Elementary Principles of Nature*, and brought arguments, ſupported by facts, to prove their exiſtence; ſuch arguments, as bring full conviction to my own mind, and make me ready to defend them, as being the real *primary inſtruments* in the hands of the Deity, by which alone all the phenomena of nature are produced; and conſequently, 'till thoſe arguments and *facts* ſhall be *diſproved*, and the *non-exiſtence* of thoſe elements *demonſtrated*, I make no ſcruple to inſiſt upon and apply them, as *principles*, whoſe *exiſtence*

exiſtence is *fully proved*, and whoſe ſufficiency to account for every appearance in nature, is convincing and ſatisfactory.

Having therefore taken a *general view* of nature, the *principles* of which *all things* are compoſed; the *laws* governing thoſe principles: and the facts *proving* their exiſtence; aſſuming them as granted, I ſhall proceed to examine them more particularly, and firſt of all, the *Earthy Principle*.

SECTION III.

On the Earthy Principle.

THE exiſtence of an earth, as a fixed principle in nature, hath never been called in queſtion. 'Tis known by its *ſolidity* or the firmneſs, and impenetrability, of its ultimate particles: by its *affinity* to *acids*, in different proportions, producing ſaline matters of different kinds, perfectly neutral when ſaturated: and by its capability of *uniting* with *phlogiſton* in various proportions,

portions, producing *metals*, and *combuſtible* or *inflammable* ſubſtances, of different kinds, according to their relative proportions.

Every ſubſtance in nature, capable of *combuſtion* in *pure air*, muſt contain the *earthy principle* and *phlogiſton*; for by *combuſtion*, pure air is decompoſed. But pure air cannot be decompoſed, but by a double affinity: the acidifying principle, will never part from its æther, but when it is attracted by the *earthy principle*: nor the æther from its acidifying principle, but when it is attracted by *phlogiſton*; and when thoſe united attractions, overpower the attractions of the æther to its acid, and the earth to its phlogiſton, a decompoſition muſt take place; the *earth* and acid will unite, and form the reſiduum: while the æther and *phlogiſton* produce the *fire* and *light* attending combuſtion, and produced by it.

Every ſolid ſubſtance then, compoſed of the *earthy principle* and *phlogiſton*, is *combuſtible* or deſtructible in *pure air*, in ſuch a degree of heat, as is neceſſary to weaken the affinity, between the earth and phlogiſton, by inſinuating itſelf betwixt them, and expanding the *phlogiſton* to a greater diſtance from its earthy baſe; by which, its affinity will be leſſened, as the expanſion increaſes; till at length its attraction to the æther of the pure air, will *exceed* the attraction of its centre.

The earthy principle, *ſaturated* with the *acid principle*, forms a neutral compound, having no attraction to acids or earth: ſhewing no ſigns of *phlogiſton*, when heated in pure air: nor any of *ether* in inflammable air, by decompoſing them: an earth *ſuperſaturated* with the *acid principle*, forms the different *acids*. But if *not* ſaturated with it, the compound will be an alkali or earth, having an avidity to unite with *acids*.

But, earth may enter into a number of compoſitions very different from theſe ſimpler ſtates; for inſtance, an earth may be partly ſaturated with acid, and partly with phlogiſton, and that in an infinite variety of proportions; in which caſe, it will partake of the properties both of the inflammable, and neutral ſaline combinations; or it may be combined with ſome phlogiſton, and ſome acid not wholly diveſted of æther; and theſe in a variety of proportions, which at preſent it is not neceſſary to conſider. However, we may ſay that *every ſolid particle* of fixed matter, capable of *uniting* with an *acid* or with *phlogiſton*, is a particle of the earthy principle.

Every ſolid or fluid matter, capable of *combuſtion* in *pure air*, contains the *earthy principle* combined with *phlogiſton*; and every ſolid or fluid matter, having *no affinity* with either acid or earth, and not deſtructible or combuſtible in either *pure* or *inflammable* air, is compoſed of the *earthy principle*, combined to ſaturation with the *acidifying principle*; and by theſe *general properties*, the *earthy principle* may be always known when preſent.

Having pointed out its diſtinguiſhing properties, let us next endeavour to acquire the ſimpleſt idea poſſible, of this earthy principle, conſiſtent with reaſon, and the properties it muſt poſſeſs as a principle, ſubject to certain invariable laws.

The

The ſimpleſt idea we can form of matter, is, that of a *ſolid point* or *particle*, ultimately ſmall, poſſeſſed of *no* property but *impenetrability*. A particle of this kind, I would call a *particle* of *inert matter*; but to render theſe particles *uſeful* in nature, 'tis neceſſary that they be alſo poſſeſſed of the *ſimple property* of *univerſal attraction*.

But a particle of the *earthy principle*, gives a more complex idea, as requiring the *properties* of *attraction* to the *acidifying principle* and to *phlogiſton*, and *repulſion* or *inability* to *unite* with *æther*.

In like manner, a particle of the *acidifying principle* differs from a particle of fixed matter, in having an *attraction* to, or power of uniting with the *earthy principle* or with *æther*, but refuſing every connexion with *phlogiſton*; and the ſame may be ſaid of æther and phlogiſton, each *will* attract *one* ſolid principle, but *not* the *other*, though they will attract each other.

But if a particle of the earthy principle, conſiſts of a *ſimple particle* of *matter*, attracting phlogiſton but refuſing æther, it muſt be *different* from a particle of the acidifying principle, attracting æther and refuſing to unite with phlogiſton; we muſt then admit of *four kinds* of ſimple particles of matter; any one of which, will unite with *two* certain others, but not with the *third*; thus æther will unite with phlogiſton, or with the acidifying principle, but not with the earthy; and *each* of theſe ſimple particles, muſt have a *power* of *choice*, or *two properties*, one of *attracting*, and the other of *refuſing* to unite with certain other particles of matter. But, this is departing from the beautiful ſimplicity of nature, and multiplying properties without neceſſity, or gaining any advantage by it, nay even involving ourſelves in inextricable perplexities.

The *ſimpleſt* idea therefore, which we can form of nature, is, that *every thing* is produced by *ſimple matter*, and *attraction:* that the baſes of all ſolid bodies are formed of particles of *fixed matter*, diveſted of every property but *impenetrability*, and *univerſal attraction:* that theſe fixed particles, as baſes, are actuated by particles of matter poſſeſſed of the property of *univerſal attraction* to themſelves, and to fixed matter indiſcriminately: that theſe active particles, when attracted by fixed particles of matter, *arrange* themſelves in *right lines*, ſo as to form *atmoſpheres* around them, and that the phenomena produced by theſe *two diſtinct active principles*, depend upon their *attraction* to *each other*, being *greater*, than the *attraction* of *arrangement* exiſting between *ſimilar particles*, when in ſtates of *equal excitement*, and extending beyond *a certain diſtance*, from their *exciting centres* of *fixed matter*; for to *that certain extent*, they are *inſeparable* from their fixed centres, and can only *draw* thoſe centres into *contact*, without being able to *ſeparate* from them.

That there are *ſolid* particles of matter, none can deny: that there is an *attractive* power, no one can refuſe aſſent to, and that there is a *polarity* or *mechanical arrangement* in particles of matter, none can deny who hath ever ſeen, and paid attention, to the regular arrangement of the particles of water, ſalts and metals, when loſing their fluid ſtate, they become ſolid, and unite with each other at certain angles, ſo as to produce cryſtals, or *regular* figures.

The *active* particles of matter, therefore, being of *two kinds*, muſt form *atmoſpheres* around the *fixed particles* of matter, which they meet with, diſengaged; and this *firſt ſimple union*, nothing hath power to entirely ſeparate or deſtroy: *each* active principle, having an *equal* attraction to theſe *fixed* particles, would *originally* unite itſelf to its ſhare of them: and *that* union would produce *particles* of *fixed matter*, with *active atmoſpheres*, *different* from each other, as being compoſed of the *two* different *active fluids*.

A particle of the earthy principle therefore, as before concluded, is a particle of *fixed* matter, ſurrounded by an *ætherial* atmoſphere; conſequently it will attract *phlogiſton*, becauſe æther and phlogiſton have a ſtrong affinity to each other; and for the ſame reaſon, will it unite with a particle of the acidifying principle, becauſe it is compoſed of a particle of matter, with a *phlogiſtic* atmoſphere.

I by no means wiſh to *inſiſt* upon the particles of *matter* forming the *baſes* of the earthy and acidifying principles, being *exactly ſimilar* in every property: nor, that a particle of earth, is a particle of *fixed matter*, ſurrounded with an atmoſphere of *æther*: and a particle of the acidifying principle, a *ſimilar* particle of matter, with a *phlogiſtic* atmoſphere; but every circumſtance conſpires to make me believe it.

All that I inſiſt upon is, that a particle of the earthy principle, will attract and unite with a particle of the acidifying principle, or with phlogiſton, but not with æther; a particle of the acidifying principle with earth, or æther, but not with phlogiſton; and æther and phlogiſton with each other. But to avoid multiplying cauſes, properties or principles without neceſſity, it appears *reaſonable* and *neceſſary* to me, that, the *baſe* of an earthy and of an acidifying particle, be a particle of the *ſame kind* of *fixed matter*: and that their earthy or acidifying properties, as *principles*, depend upon their being *united* to, or *ſurrounded* by *one* or *other* of the two active principles, by which they become active principles, a fixed particle having a *phlogiſtic* atmoſphere, becomes poſſeſſed of the properties attributed to the *earthy principle*, and with an *ætherial* atmoſphere, it acquires the properties which diſtinguiſh the acidifying principle.

By admitting this explanation, we have in reality, no occaſion for *more* principles than *three; fixed* particles, and *two* active fluids: each of which active fluids is compoſed of particles, which being attracted by fixed matter, become excited, to *attract each other* into atmoſpheric arrangement, around the exciting fixed centres: or the particles of the *other* kind, in a ſimilar ſtate of excitement, into *union*, by which their reſpective fixed centres, are drawn and held firmly together. The two active principles of nature, therefore, are *æther* and *phlogiſton:* each of theſe when combined with *fixed* particles of matter, becoming active, can never more be intirely ſeparated from thoſe exciting fixed particles, and will therefore form *two* other *more ſolid principles*, the *earthy* and *acidifying;* æther combined with or ſurrounding fixed particles, forming the *earthy principle*, and phlogiſton with the ſame kind of fixed particles, the *acidifying principle*; and the earthy and acidifying principles muſt, on account of their actuating atmoſpheres, have the *ſame* affinity to *each other*, that æther and phlogiſton have.

'Tis evident likewiſe, that a particle of the acidifying principle having a phlogiſtic atmoſphere, will attract æther alſo, as well as the ætherial atmoſphere of the earthy particles; and that particles of the earthy principle, will attract *phlogiſton*, as well as the phlogiſtic atmoſphere of a particle of the acidifying principle; and for the ſame reaſon, that is, the attraction of union, exiſting between the two active fluids, æther and phlogiſton.

But ſimilar principles, or particles of fixed matter poſſeſſed of ſimilar atmoſpheres, as hath before been ſhewn, will *not* unite: becauſe, ſimilar particles, of the ſame active fluid, when excited by their union with fixed matter, have *no attraction*, but to that fixed matter, except the attraction of *arrangement*, with reſpect to each other: by which they unite, ſo as to take an atmoſpheric form, around the fixed ſubſtances, or particles, as centres; conſequently, two ſimilar particles will not unite: each atmoſphere tending to its reſpective centre.

To explain my idea of theſe *four* principles, and their mode of action ſtill further, and at the ſame time, prove that they are perfectly conſiſtent with nature, let us *ſuppoſe four* cork balls, ſuſpended by ſilk cords, to repreſent *four* particles of *fixed* matter, having no powers, or properties, but impenetrability, or ſolidity: the *two electricities*, will repreſent the *two* active fluids: *poſitive* electricity being ſuppoſed to be *æther*, and *negative* to be *phlogiſton*.

If two of theſe balls be *poſitively* electrified, they will repreſent two particles of the *earthy* principle, having each a fixed or ſolid centre, ſurrounded by an *ætherial* atmoſphere.

If the other two be *negatively* electrified, like two particles of the acidifying principle, they will have atmoſpheres of *phlogiſton*.

The two balls poſitively electrified, will *not* unite, but recede from each other, like two particles, of the earthy principle: and the two negatively electrified balls, will refuſe to come in contact with each other, in the ſame manner, as two particles of the acidifying principle refuſe to unite.

If one of the balls *poſitively* electrified, be brought between the two *negative* balls, they will attract, and unite with each other, in the ſame manner, as two particles of the *earthy principle* unite, and form a ſolid, by the interpoſition of *phlogiſton*. And a ball negatively electrified, will forcibly attract another poſitively electrified, in the ſame manner, as a particle of the earthy and acidifying principle, will attract and unite with each other. And the light and heat, produced by the union of theſe two oppoſite electric atmoſpheres, when uniting, and ſeparating from their reſpective centres of matter, is juſt *the ſame*, as the light and heat produced, when the phlogiſton of one ſubſtance is diſengaged from its baſe, and combines with the æther ſeparated from another ſubſtance, of a different and oppoſite nature.

I have been thus explicit here, that my meaning might be perfectly underſtood; and have made the preceding compariſon, not only by way of elucidation, but alſo to ſhew, that the ideas I have formed, with reſpect to the *acidifying* and *earthy principles*, being poſſeſſed of *ſimilar* particles of *fixed matter*, as *baſes*, ſurrounded by *atmoſpheres* of the *two different active fluids*, are ſimilar to, and perfectly conſiſtent with the operations of nature, and properties of matter, every moment preſented to our view.

But according to the general laws laid down and explained in p. 34, and p. 39. prop. 15. it appears that either æther or phlogiſton, when ſurrounding a fixed particle of matter, ſo as to form a compound or ſolid principle, to a *certain extent* around that centre, is excited to attract *ſimilar particles* to atmoſpheric arrangement, *ſo powerfully*, as *never more* to be ſeparated; but *beyond* that certain extent, the active particles have a *greater* attraction or diſpoſition to unite, with the *oppoſite kind* of particles, than to extend themſelves, by taking more ſimilar particles into arrangement; conſequently, the atmoſphere of *either principle* being naturally *violently excited*, and always ſurrounded by the oppoſite active fluid in ſome ſtate or other, will conſtantly attract it in that ſtate; thus, the *earthy principle*, being a fixed particle of matter, ſurrounded by *æther* to that certain extent, will unite itſelf either to the *phlogiſtic* atmoſphere of the acidifying principle, and form a neutral compound: or to diſengaged *phlogiſton*, with which it will invelope itſelf as a *ſecond* or *external atmoſphere.* And in the ſame manner, the *phlogiſtic* atmoſphere of the acidifying principle, will either ſatisfy itſelf with the *ætherial* atmoſphere of the *earthy principle*, or will take an *external* atmoſphere of *æther.* So that on account of the *violent* degree of excitement, of the atmoſpheres, ſurrounding the fixed centres *as principles*, we *can never* procure thoſe principles, totally diſengaged, either from the oppoſite *fixed* principle, or the *active* principle of the contrary kind. The earthy principle therefore, when in the ſtate the *moſt diſengaged* from the acidifying principle, which we can procure, will ſtill *not* be the *pure earthy principle:* becauſe its *ætherial* atmoſphere will then attract a *phlogiſtic* one; and upon *that phlogiſton,* its *alkalinity* ſeems to depend. If the quantity, or extent of phlogiſton be *ſmall,* its excitement, and activity will be ſo much the *greater,* rendering the earthy particle *cauſtic* or *alkaline;* if the phlogiſton be *more* abundant, its *alkaline* properties will be *leſs* powerful, or evident.

Thus *volatile alkali,* when deprived, as much as poſſible, of acid, and phlogiſton, by any other ſubſtance having a greater affinity with them, as for inſtance quick-lime, is rendered powerfully *cauſtic* and *alkaline*; but if heated, it will decompoſe the fire, by attracting its *phlogiſton,* and become *alkaline air,* (for if it did not *decompoſe* the fire, it could not become *permanently* elaſtic) in which ſtate, it is *leſs* cauſtic or alkaline than before; and if this alkaline air, hath an opportunity, of acquiring *ſtill more phlogiſton,* from the electric fluid, paſſed through it in ſhocks, it will ſtill *further expand* itſelf, and become *inflammable*; in which ſtate, the *quantity* of *phlogiſton*, ſurrounding the *ætherial* atmoſpheres of the earthy principle, is *ſo great*, and conſequently ſo *little excited*, as to ſhew *no* ſigns of cauſticity or alkalinity.

The *alkaline* properties therefore, of the *earthy principle*, depend upon the *phlogiſton* ſurrounding its *ætherial atmoſphere*; and the degree of alkalinity, muſt be inverſely proportionate to the quantity of phlogiſton: or directly ſo, to the excitement of that phlogiſton.

I ſhall now conclude this Section with the following definition.

A particle of the *earthy principle* is a particle of *fixed* matter, ſurrounded to a certain extent, by an atmoſphere of *æther*; in conſequence of which, it hath an *affinity* to the *acidifying principle*, on account of its phlogiſtic atmoſphere: and alſo to *phlogiſton*, by which being ſurrounded, it acquires the properties which conſtitute an alkali.

SECTION IV.

On the Acidifying Principle.

HAVING entered ſo largely into the nature of the more fixed principles of nature, or thoſe forming the baſes, of all ſolid ſubſtances, generally ſo called, in the preceding Section, where this principle of acidity was alſo taken into conſideration, ſo far as it was related to the ſubject, by its affinity with the earthy principle, there treated upon: and having there given my reaſons, for ſuppoſing, that *both* the earthy and acidifying principles, are compoſed of *ſimilar* particles of fixed matter, ſurrounded with atmoſpheres of *different active* fluids; by which union they become *active principles*, reſembling the fluids which give them their activity, and different properties, and their attraction to each other, I ſhall have leſs to ſay upon the preſent ſubject.

Acids are univerſally known, and their exiſtence conſequently generally allowed, as admitting no denial, and wanting no demonſtration.

The acidifying principle, is capable of taking different degrees of fluidity or ſolidity, according to circumſtances, and its mode of combination; for, a pure uncombined acidifying particle was never ſeen, nor ever can be, no more than a particle of the earthy principle, pure and uncombined; yet, an acid in every ſtate, ſufficiently manifeſts the exiſtence, ſolidity and impenetrability of its particles.

'Tis known, in *certain ſtates*, by its taſte: alſo by its affinity to earthy or alkaline ſubſtances, and by its attraction to æther.

With the earthy principle, combined to ſaturation it forms neutral compounds: if the *acid* principle predominates, different acids are formed: if it be inſufficient to ſaturate the earth, the compoſition is known by the names of calcareous earths, alkalis, &c. and by the property of attraction to acids.

With æther it forms pure air, and the different kinds of acids, which differ in the *quantity* of *æther* they contain; ſo, that the *differences* between the various kinds of *acids*, depend upon the proportion of *æther* they retain: the quantity of *earth* united with them, or *both;* and the neutral ſalts, formed by the combination of theſe different acids, with earthy ſubſtances of different degrees of purity, will differ from each other alſo. So that the acidifying principle, may be partly or wholly ſaturated, either with *earth* or *æther:* or it may be partly ſaturated with earth, and partly with æther:

or

or it may be combined with æther, and an earth partly ſaturated with phlogiſton, producing an infinite variety of compound ſubſtances, of different properties, according to the different principles, or proportions of thoſe principles, entering into their compoſition.

Every fluid or ſolid ſubſtance in nature, capable of effecting the *decompoſition* of *inflammable* matters, or phlogiſtic ſubſtances, or ſupporting their combuſtion, muſt contain the *acidifying principle* and *æther*. For the earth and phlogiſton of inflammable, or phlogiſtic ſubſtances, will never ſeparate, neither will the acidifying principle and æther, unleſs *each* of *them*, can meet with the *other* principle to which, *in thoſe circumſtances*, it can more *intimately* unite, than to *that* with which it *now* is combined; therefore, every ſubſtance capable of promoting, or effecting the decompoſition of inflammable matters, muſt contain, and furniſh *æther*, to combine with the phlogiſton, diſengaged from the earth; by the union of that earth with the *acidifying principle*, depoſited by the æther; the earth and acid forming a *calx*, or reſiduum:

duum: and the æther and phlogiſton, *fire* or *light*.

If the earthy principle contains a *ſuperabundance* of phlogiſton, and that phlogiſton during combuſtion, be ſaturated with æther, the *quantity* of acid diſengaged from that æther, if the æther and acidifying principle were combined to ſaturation, as in pure air, will *as much exceed* the point of ſaturating the earth, as the *phlogiſton* did, which is now ſeparated from it; and conſequently, the reſiduum muſt be an *acid*, or an earth *ſuperſaturated* with *acid*.

But, if the earth be *not* ſaturated with phlogiſton, the quantity of æther required to ſaturate that phlogiſton, will depoſit a quantity of acid, *not ſufficient* to ſaturate that earth; therefore, the reſiduum will ſtill have a power of attracting more acid.

Indeed, an infinite variety muſt take place, not only in the *reſidua* or combinations of the two fixed principles, but *alſo* in the combinations of the *two active principles*, and the admixture of fixed ed principles they may retain after certain decompoſitions, according to the different proportions, which they bear to each other, in the ſubſtances employed, and producing thoſe decompoſitions, and new combinations.

Every ſolid or fluid matter, therefore, capable of effecting the *combuſtion* of *inflammable ſubſtances*, or ſubſtances compoſed of the *earthy principle* and *phlogiſton*, muſt be compoſed of *æther* and the *principle* of *acidity;* and every ſubſtance having an affinity with either the earthy principle or æther, is a particle of the acidifying principle.

But, for the reaſons delivered in the laſt Section, on the earthy principle, and in the former parts of this work, it appears, that this acidifying principle is compoſed, of a *fixed particle* of *matter*, ſurrounded by an *atmoſphere* of *phlogiſton*, to a *certain extent;* to which diſtance from the fixed exciting centre, its particles are *ſo ſtrongly excited* to *arrangement*, and ſo powerfully attracted by that fixed centre, as to be *inſeparable*. But *beyond* that extent, the phlogiſtic particles being leſs forcibly excited to attract their centre, acquire a *ſtronger* diſpoſition to unite with *æther*, than to take a *greater* extent of *phlogiſtic* particles into arrangement; conſequently, the acidifying particles, will forcibly attract the *earthy particles* on account of their ætherial atmoſpheres; or if thoſe are abſent, they will attract the *æther*, every where preſent, which will form an *external atmoſphere*, around the *eſſential phlogiſtic* one. Upon this external atmoſphere of æther, the *acidity* of the particles depend: the *more extenſive* the ætherial atmoſphere, the *leſs* the degree of excitement, and manifeſt acidity; but when the quantity of æther is ſmall, its excitement muſt be great, and its activity and acidity powerful.

Thus, particles of the acidifying principle, with *large* external ætherial atmoſpheres, form *pure air*, where no ſigns of acidity are perceived: but if part of that æther be taken away, by combuſtion, or any other means, the *acidity* will become evident, and the particles no longer capable of preſerving their aeriform ſtate, will be condenſed into that of a *liquid acid*. We may therefore give the following *definition*:

A *particle* of the *acidifying principle*, is a *fixed* particle of matter, ſurrounded by an atmoſphere of *phlogiſton*, to *that extent*, where it *ceaſes* to be *inſeparable*, and acquires a *ſtrong attraction* to *æther*; conſequently, it will have an *affinity* with the *earthy principle*, on account of its *ætherial* atmoſphere; and alſo an attraction to *diſengaged æther*, which being excited to ſurround it, acquires all thoſe properties which conſtitute *an acid*.

Having now pointed out the *diſtinguiſhing*, or *characteriſtic* properties of the *earthy* and *acidifying*, or the *two fixed principles*, forming the *baſes* of *all ſolid bodies*; and endeavoured to ſhew their *natures* and *affinities*, and to trace them to the *ſimpleſt* ſtate, of which we can form any idea of them, conſiſtent with reaſon: I ſhall next proceed, to conſider the *two active principles*, *Phlogiſton* and *Æther*, in order.

SEC-

SECTION V.

On Phlogiſton.

IN the former parts of this work, I have endeavoured to ſhew, not only the abſolute neceſſity there is, to admit of *two active principles* in nature, but alſo, that they do in reality exiſt.

Theſe two active principles or fluids, with ſolid or fixed particles of matter, form *two* ſecondary, or compound, but *more fixed principles*; thoſe compound

pound fixed principles in *certain* ſtates, are univerſally called *Earth* and *Acid*, and the two active fluids I call *Phlogiſton* and *Æther*.

Theſe *two active fluids* muſt be material, becauſe they exiſt, and are capable of uniting with fixed matter, and giving it new properties; and of uniting with each other and producing effects evident to the ſenſes; nay even when excited *alone*, they are capable of manifeſting their *exiſtence*, and *materiality*.

But when they form magnetic, electric, or aeriform atmoſpheres around *ſolid matter*, though evidently material, they have not that ſolidity, and viſibility which ſolid ſubſtances have: conſequently, their particles muſt have large, and numerous *interſtices* between them, which muſt ariſe from the *peculiar arrangement* which takes place, amongſt thoſe particles, when excited; and the power of reſiſtence, and force of attraction muſt diminiſh, in proportion to the diſtance from the ſolid centre, as it is natural to ſuppoſe, from the arrangement the active particles take in right lines like radii, in every direction, round their centres: the diſtance between thoſe lines being inverſely proportionate to their excitement, and, *that* to their diſtance from the centre.

This arrangement of active particles, at once explains the nature of elaſtic or aeriform fluids, with ſolid baſes; and alſo the power of excited atmoſpheres, either to reſiſt or attract, being greater as the lines approach each other and the centre; and unleſs we admit this mode of explanation, 'tis impoſſible to account for a number of phænomena, which we cannot deny.

The calx of antimony, conſiſts of particleswhich will not even unite into a ſolid form; but ſupply the requiſite quantity of phlogiſton, and they will become a ſolid, where the methodical arrangement of its particles, at certain angles, with reſpect to each other when conſolidating, producing a figured form, is too evident to be denyed. Here then, as well as in many other inſtances, we have a peculiar polarity, or arrangement taking place, between the particles of matter; and that property of methodical arrangement, evidently depends upon the *phlogiſton*; conſequently, I have authority from nature to ſuppoſe, that particles of *phlogiſton*, have a certain *polarity* or *arrangement* amongſt themſelves, when excited by *fixed matter;* and the cryſtallization of acids, proves that particles of *ether* have ſo too.

Allowing therefore that active particles of matter, by excitement, take an atmoſpheric form: that their activity depends upon their property of univerſal attraction to each other, and to fixed matter; and finding that *ſome* atmoſpheres will *reſiſt* each other, while *others* will *attract* and *unite*, as before more largely conſidered, we muſt conclude, nay we are certain, that theſe *active* atmoſpheres are of *two* kinds: ſimilar in attraction to each other, and to fixed matter, but differing when excited, in this, that *ſimilar* atmoſpheres, or atmoſpheres of the ſame kind of active fluid, will *not* come nearer than ſimple contact; but, atmoſpheres of the two *different* kinds, will *penetrate* each other, and *unite*.

Phlogiſton therefore is a ſubtile, elaſtic fluid; compoſed of particles of matter, actuated by the property of attraction; when theſe particles are excited, they have an attraction for each other, producing an arrangement in right lines: in conſequence of which, they aſſume an *atmoſpheric form*, around the ſolid ſubſtance, or particle as a centre.

Theſe phlogiſtic particles, are powerfully attracted by *fixed* particles of matter; by which attraction of union, they become excited to arrangement, and form atmoſpheres around thoſe fixed particles never more to be ſeparated intirely. Theſe *fixed* particles with *phlogiſtic* atmoſpheres, being *unalterable*, form the fixed or ſolid principle of nature called the *acidifying principle*.

The particles of phlogiſton, have an attraction to the particles of *æther*, when diſengaged, or in a ſimilar ſtate of excitement: by which, they can unite; and if at the ſame time they become diſengaged from their ſolid baſes, they form *fire*, or *light*, according to the degree of intimacy with which they combine. Phlogiſton hath alſo an attraction to particles of the earthy principle, becauſe they are compoſed of particles of fixed matter, with ætherial atmoſpheres.

Particles of phlogiſton, ſurrounding a ſolid centre of fixed matter, will to a certain diſtance attract that centre, more powerfully than æther; but beyond that diſtance, they will have a more powerful attraction to the particles of æther, in a diſengaged ſtate, than to their fixed baſes; in conſequence of which, the æther will be excited to take an atmoſpheric arrangement around them.

Particles of phlogiſton, when excited to arrange themſelves round ſolid ſubſtances, with which they *cannot* enter, into *cloſe* or *chemical* union, will *leave* thoſe ſubſtances, and *loſe* their atmoſpheric arrangement, to combine with *æther* in ſimilar circumſtances.

Diſengaged particles of phlogiſton, when they meet with ætherial excited atmoſpheres, which cannot quit their baſes, become excited by the external particles of æther, and form a *phlogiſtic* atmoſphere, around the *ætherial* one.

Every ſubſtance therefore, capable of yielding *light* or *fire*: or every *combuſtible* or *inflammable* matter, capable of being *decompoſed* in *pure air*, muſt contain *phlogiſton*, united to the *earthy principle*; and conſequently,

Phlogiſton united to the earthy principle, produces according to the different proportions, in which they enter into compoſition, *all* the ſubſtances, which are *inflammable* or *combuſtible* in pure air, or with ſubſtances containing the *acidifying principle* and *æther*.

Phlogiſton with *æther*, forms *fire* or *light*, according to the mode, or force of combination.

Phlogiſton with the acidifying principle, will *not* unite; becauſe an acidifying particle, is already ſurrounded by an *atmoſphere* of *phlogiſton*.

Phlogiſton may therefore be known, by its uniting with particles of the *earthy principle*, and giving them ſolidity, or cohesion, or when *more* abundant, by giving them the elaſtic form of air: and by its power of *decompoſing pure air*, or compounds of the acidifying principle and æther, by uniting with the *æther*, and paſſing off in the form of fire or light, and leaving its earth, to unite with the acid left by the æther.

But beſides theſe ſimpler ſtates, phlogiſton may exiſt in a great variety of compoſitions; it may be *partly* united to the earthy principle, and partly with æther; or to an earth, or to æther part-ſaturated with the acidifying particles; or to an earth, and at the ſame time, partly to æther not wholly diveſted of its acidifying particles.

We may therefore conclude this Section, with the following definition.

Phlogiſton is a principle, compoſed of particles of matter, poſſeſſed of the *active* property of *attraction*;

attraction; when excited by their affinity to *fixed* matter, they have an attraction of *arrangement* amongſt themſelves, forming lines of particles, around their exciting centres, of fixed matter, in an atmoſpheric form; with *æther* it will *unite*: and likewiſe, with the *earthy principle*; but *not* with a particle of the *acidifying* principle, becauſe, it is a particle of fixed matter, already united to a ſurrounding atmoſphere of phlogiſton.

SECTION VI.

On Æther.

ÆTHER is that active matter, which when united to particles of the acidifying principle, in a full proportion, gives that ineſtimable fluid, *pure air.* Pure air, we know, contains a ſmall quantity of *acid* particles, as its baſe, which in that *aeriform* ſtate, muſt be very diſtant from each other, and poſſeſs a wonderful elaſticity; were the ſurrounding preſſure removed, they would expand into a bulk ſtill much more extended, where the particles of acid, would be ſtill further removed from each other, as I have before inſiſted. A particle of matter cannot act where it is not, conſequently, the expanſive power, by which theſe particles of acid are kept aſunder, at a diſtance, inverſely proportionate to the preſſure, or reſiſtance, they meet with, muſt be a *ſomething*, *different* from the acidifying fixed particles themſelves, forming an atmoſphere around each of them: which atmoſphere, is capable of condenſation, or extenſion, and therefore muſt be elaſtic; and as the particles of which theſe atmoſpheres are formed, muſt be ſolid matter, and conſequently impenetrable, 'tis certain, that theſe particles, do not *touch* each other, in *all directions*, as they then would form a ſolid, opaque maſs: but they do not, becauſe they are penetrable to light, fire, and ſolid matter of every kind, when in motion, to which they give little reſiſtence. But though they touch not each other, in *all* points, or directions, they muſt in *ſome*, becauſe they attract and unite with each other, and therefore muſt be in contact: conſequently, they muſt form *lines* of active particles, around the *acidifying particles*, as *centres*, diverging as they recede from thoſe centres.

Whatever this *active ſomething* may be, which can give to particles of the acidifying principle, an aeriform ſtate, I call it *æther*. That it is not phlogiſton, many operations of nature, and chemiſtry, prove; though phlogiſton is a principle, *equally active*, and poſſeſſed of the *ſame* property of atmoſpheric arrangement, when excited by fixed matter; yet they differ in their affinities.

Whatever therefore, is capable of giving the acidifying principle an *elaſtic* form, by uniting with it, ſo as to be able to ſupport, and effect the *decompoſition* and combuſtion of inflammable ſubſtances, muſt contain æther; which, uniting with the *phlogiſton* of the inflammable or combuſtible body, will form *fire* or *light*, and depoſit its acidifying particles, to combine with the earth, diſengaged from its phlogiſton.

Æther, with a *ſuperabundance* of acidifying particles, will not be able to ſupport *that* quantity, in an *aeriform* ſtate, in a moderate temperature of heat; the compound will therefore, be *a liquid*, and that liquid evidently *acid*. Acids will differ from each other, in proportion to the quantity of æther they contain, in any certain quantity of acid; and they may have other different properties, ariſing from the admixture of pure earth, in different proportions; or even of earth, partly combined with phlogiſton.

Neither æther, nor phlogiſton *alone*, can produce heat; but we know that they will attract each other: and that when they ſeparate from their reſpective baſes, and are loſt as ſuch, their eſcape is always in the form of *fire* or *light*.

Light we know, may be changed into fire, by condenſation, and violent commotion; as is evident, from the fire, or heat produced by the rays of light, condenſed in a focus upon any opaque body, in the open air, or in vacuo; which proves, that *æther* and *phlogiſton*, are capable of uniting, with *different* degrees of force, or intimacy: perhaps, the moſt violent, or intimate union, producing fire; and the revival of metals, and production of pure air at the ſame time, by means of fire or light alone, fully proves, that *either* of them muſt impart *phlogiſton* to the earthy, and *æther* to the acidifying particles, to give them their metallic, or aeriform ſtates; and conſequently, that both fire and light, are compoſed of æther and phlogiſton.

Æther therefore, will unite with phlogiſton or the acidifying principle: but it hath no affinity with the earthy principle. But, if the particles of æther, are actuated by the property of *univerſal* attraction to matter: and a particle of earth be a *ſimple* particle of matter: æther ought to attract *that particle* of the earthy principle; but it will not: conſequently, either the particles of æther, have a power of *chuſing* with what they will unite, and what they will not, or otherwiſe, a particle of the *earthy* principle, is *not* a *ſimple particle* of *matter*. But, to allow the former, will be granting to matter, different and inconſiſtent properties, without any neceſſity for departing from the more ſimple, and ſingle property, *univerſal attraction:*

attraction: therefore, I conclude, that a particle of the *earthy principle*, is *not* a *ſimple* particle of matter; and indeed after ſhewing that *fixed* particles of matter do exiſt, and likewiſe two *active* fluids, equally powerful in their attractions to thoſe fixed particles, 'tis impoſſible to deny that thoſe *active* principles, when once united to thoſe *fixed* particles, can never more be ſeparated entirely; and conſequently, that the particles of *fixed* matter, ſurrounded by, and united to *æther*, will by that means acquire active properties, different from thoſe actuated by *phlogiſton*; in the ſame manner, as æther and phlogiſton differ from each other.

But, as æther is known to have an affinity to *phlogiſton*, and an attraction for the *acidifying* principle, 'tis evident, that a particle of that kind being a particle of fixed matter, muſt have a *phlogiſtic* atmoſphere; and a particle of the *earthy* principle, only differing from an acidifying particle, in its actuating atmoſphere, muſt have an atmoſphere of *æther*; with which, particles of æther have no affinity, but that of *arrangement*.

Æther therefore, is an *active principle*, compoſed of particles of matter, endowed with the property of *attraction*, to every other kind of matter, exiſting in nature; and in conſequence of *that* attraction, becoming *excited*, they attract each other, and *arrange* themſelves in *right lines*, ſo as to aſſume the forms of *atmoſpheres*, around the *ſolid centres*, by which they are attracted. A particle of *fixed matter*, thus ſurrounded by *æther*, forms an *inſeparable compound*, which is called the *earthy principle*.

The particles of æther, when excited by a body whoſe particles already poſſeſs *atmoſpheres* of *phlogiſton* of a certain extent, with which they cannot enter into *intimate* or *chemical* union, will form themſelves into an atmoſphere, *around* the *phlogiſtic* one: which external atmoſphere will ſeparate from that body, entirely, to combine with an atmoſphere of excited phlogiſton, in a *ſimilar* ſtate.

An atmoſphere of æther, *conſiderably* excited around a body, with which it *cannot* intimately combine, will attract the ſurrounding *phlogiſton* diſengaged, or *lightly* connected with other bodies: to which however, in *this* ſtate of excitement, it hath *leſs* attraction, than to the *exciting body;* conſequently, it will *not* quit its *atmoſpheric arrangement*, but attracting the *phlogiſton* to the *ſurface* of its atmoſphere, *thoſe* particles of *phlogiſton*, will become *gently excited*, and form an *atmoſphere* of *phlogiſton*, around the *ætherial* one; in like manner, an excited atmoſphere of *phlogiſton*, may be ſurrounded *by* an atmoſphere of *æther*.

The definition, of the *ætherial principle*, with which I ſhall conclude the Section is *this*.

Æther is a *principle*, compoſed of particles of *matter*, actuated by the property of attraction, or the power of uniting, with *every other* kind of matter: by which union, they become *excited* to *attract each other*, and *arrange* themſelves in *right* lines, forming *radii* around the ſolid centres, extending in every direction, like an *atmoſphere*. It hath an attraction to *phlogiſton*, and to the *acidifying principle:* with *both* of which it will *unite*, in any proportion; but, it hath *no* affinity with the *earthy* *principle*, becauſe, its properties as a principle, depend, upon its being *already united*, to a ſurrounding *atmoſphere* of *æther*; to which, it therefore, can have no affinity of union.

Having now taken a view, of the *ſimple principles* of nature: their *properties*, and the *laws* by which they are governed: and given ſuch definitions of them, as cannot fail, to enable us, with certainty, to diſtinguiſh them, ſrom each other; I ſhall next proceed, to conſider, the *different ſtates* of compound bodies, with reſpect to *ſolidity* and *fluidity*.

SECTION VII.

On the Attraction of Coheſion, and the Cauſes on which the different degrees of Solidity, or Fluidity of Bodies, in the common temperature of heat, depend.

SIMPLE particles of homogeneous matter, having no attraction of union for each other, can never *per ſe*, become ſolid; therefore, the *attraction* of *coheſion*, muſt depend upon *ſome other principle*,

principle, being *interpoſed*, having an *attraction* to *thoſe ſimple particles.*

The baſe of every ſolid ſubſtance, is either of the earthy or acidifying principle; conſequently, *particles of either* of them may be rendered *ſolid*, by means of a certain proportion, of *either* of the *two other principles*, to which they have *an affinity*.

Thus, particles of the *earthy principle*, may be united together, by means of *phlogiſton*, or the *acidifying principle*; and particles of the *acidifying principle*, by the interpoſition of *æther* or *earth*.

Particles of the earthy principle with *phlogiſton*, not ſufficient to ſurround them, with *complete* atmoſpheres, mutually attract *thoſe interpoſed* particles of phlogiſton, by which they become *united*, *firmly* to each other. Thus, Metals are compoſed of particles of the earthy principle, united by a *ſmall* proportion of phlogiſton; hence their great ſolidity, and ſpecific gravity.

Particles of the earthy principle, with a *greater* quantity of phlogiſton, cannot attract with ſo much force as the former: therefore they will form compounds, *leſs ſolid* or *ponderous*, and *more* inflammable; ſuch are the *ſolid* inflammable ſubſtances in general, as Bitumens, Reſins, Wax, &c. But, if the proportion of phlogiſton be *ſtill greater*, the particles will have a freedom of motion amongſt themſelves, and form inflammable *liquids*; as for inſtance, Alcohol, and Oils of different kinds.

But, with a quantity of phlogiſton, ſufficient to give the earthy particles *complete* atmoſpheres, they will become *elaſtic*, or *aeriform fluids*; as for example, Inflammable Air.

When particles of the earthy principle are united by means of *phlogiſton*, the *ſmaller* the proportion of phlogiſton, if ſufficient to interpoſe between each earthy particle, the *firmer* and *more ſolid*, the union; becauſe, if the phlogiſton were ſufficient, to form a complete atmoſphere, around each particle, thoſe elaſtic atmoſpheres would no more unite, and form a ſolid, than the particles of earth themſelves.

But yet, though *ſimilar* atmoſpheres have no power of penetrating or uniting firmly with each other, they have an attraction of arrangement, which may give their external particles, a *ſlight* degree of attraction: for, the external particles of each atmoſphere, being excited, have an *attraction* of *arrangement* for each other, which attraction ſtill ſubſiſts between them, though neither of them can quit their preſent ſtate of arrangement, around their reſpective centres: and the ſmaller the atmoſphere, the ſtronger its excitement, and the greater its attraction of arrangement, to the external particles of a ſimilar atmoſphere.

Particles of the earthy principle therefore, with a *ſmall* quantity of phlogiſton, form *ſolid* ſubſtances: with a *greater* quantity, *liquids;* and with *large* phlogiſtic atmoſpheres, they take the form of *elaſtic fluids*, or *gaſes;* all of which, are inflammable, or combuſtible in pure air.

But, particles of the earthy principle, are *differently* circumſtanced, when combined with the acid principle: the *moſt ſolid* compound being produced,

ced, when the particles of earth, and acid, are equal, and *alternately* interpoſed between each other, forming a *neutral, fixed, ſolid* maſs; ſuch a ſimple combination is *glaſs.* For inſtance, a metal, its *earthy baſe* by calcination in *pure air, loſes* its *phlogiſton,* and *acquires* an *acid:* which acid and earth, being *intimately* applied to each other, by a degree of heat, ſufficient to *fuſe* them, form a *Glaſs.*

If the particles of the earthy principle have *not acid enough* to ſaturate, and firmly unite them, they form compounds *leſs* ſolid and *compact:* having ſtill an attraction to *acid particles;* ſuch are *calcareous earths.* But if the quantity of acid be very ſmall, the earthy particles will attract phlogiſton alſo, and become alkalis.

Earthy particles with a *ſuperabundance* of *acid,* form compounds, likewiſe *leſs ſolid:* ſuch are known by their affinity to earth; as the various *chemical* and native *acids,* or *acid* compounds, ſolid and fluid.

But, on account of the attraction, which the particles of the earthy principle have to phlogiſton, and to the acidifying principle, and they to æther, we perhaps have *few* compounds of the earthy principle, and phlogiſton, without an *admixture* of *æther*, or *acidifying particles* and *æther*; nor of the earthy and acidifying principles, without *ſome phlogiſton*, or *æther*, or *both*; which variety of principles and proportions, produces that wonderful diverſity of ſubſtances, of different forms, ſtates, and properties, which every where preſent themſelves to our contemplation.

The particles of the *Acidifying Principle*, being particles of *fixed* matter, with *phlogiſtic* atmoſpheres, can have *no* attraction, or power of uniting *firmly*, with each other; but, if a certain quantity of *æther* be added, *not* ſufficient to *ſurround* the acid particles, they will mutually attract it, and by *that* attraction, be *united*, and form ſolid compounds; ſuch for inſtance, I ſuppoſe *vitrifiable* ſubſtances to be.

With a *greater* quantity of æther, the acidifying particles take a leſs ſolid, or *liquid* form, producing the different kinds of *acids;* which however, in general, are not without *ſome admixture* of *earth*, and frequently of *phlogiſton* alſo. If the quantity of *æther*, be ſtill greater, the particles of the acidifying principle, will be ſurrounded by it, in an *atmoſpheric* form, taking the ſtate and properties of *pure air.*

The fixation of the acidifying particles by means of particles of earth, hath already been mentioned; and likewiſe the infinite variety of compound ſubſtances which muſt reſult, from the endleſs diverſity of proportions, in which *two*, or *more* of the principles, may be employed.

It appears therefore, that particles of the earthy or the acidifying principles, or both, form the baſes of every *ſolid*, *fluid*, or *aeriform* ſubſtance in nature: that the *leſs* the quantity of *phlogiſton*, or *æther*, combined with either the earthy or acidifying principles, ſingly, the *more ſolid* they are: that particles of the earthy principle chiefly conſolidated, or combined by means of *phlogiſton*, form the different kinds of *combuſtible* or *inflammable* bodies:

that particles of earth united by means of the *acidifying* principle, *not* ſufficient to ſaturate them, form *alkalis*, *calcareous earths*, and *all thoſe earthy ſubſtances*, capable of uniting with acids; which however in general, contain *more* or *leſs phlogiſton*, to which the earth hath a great affinity, and oftentimes by means of that acid and phlogiſton, *more* or *leſs æther* is united into the maſs, which entering in different proportions, give the properties, wherein *earths differ* from *each other*: that particles of earth, conſolidated by means of the *acidifying* principle, combined to ſaturation, produce the different kinds of *neutral ſalts*, differing in their properties, from the *ſame cauſes*, as the different earths and acids do, that is, the proportions of phlogiſton, or æther, which were united, to the earth or acid, which by their combination, are not wholly ſeparated: that particles of the acidifying principle, united by means of a *ſmall* proportion of *æther*, produce all kinds of *vitrifiable* ſubſtances, *indiſtructible* in *pure air*, but capable of *neutralizing earths* or *alkalis*; *which* will unite to their acidifying baſes, and form *neutral* compounds or *glaſſes*: and indeed, the *acidifying principle* and *æther*, form *eve-*

rything, which is *unalterable* by means of *fire*, in *pure air*: and even *pure air itſelf*, when the æther is ſufficient to give *complete atmoſpheres*, to thoſe particles of the acidifying principle. But when the acidifying particles are not *volatilized* by atmoſpheres of æther, but yet have ſuch a proportion of it, as is *more* than *ſufficient*, to attract them to *cloſe* and *ſolid union*, by ſimple interpoſition, the particles being only attracted to each other by the attraction of *arrangement*, which *each* atmoſphere exerts, upon the *contiguous* atmoſpheres, will form the different kinds of *acids*, which are capable of different degrees of ſolidity, and fluidity; and at the ſame time, are ſeldom *free*, from a conſiderable proportion of *earth*, and very frequently, have ſome ſhare of *phlogiſton*; upon which principles and proportions, their different properties depend.

Perhaps, *another* cauſe of the different degrees of ſolidity, and ſpecific gravity, may be the *quantity* of *eſſential atmoſphere*, ſurrounding a particle of *fixed* matter, giving it the properties of an earthy, or an acidifying particle; for inſtance, a

particle

particle of the earthy principle, by change of circumſtances, being *deprived* as much as poſſible of its original quantity of *æther: that* æther, will be *ſtrongly excited*, by its nearneſs, and attraction to its fixed baſe; conſequently, its attraction to phlogiſton, will be *greater*, than it would be, were its ætherial atmoſphere *larger*, or more extended; and the attraction of union between ſimilar particles, will be *more ſolid*, and the maſs *more ponderous*, by their force of attraction to the *interpoſed phlogiſton*.

Particles of the earthy principle then, form a *ſolid ſubſtance*, by their attraction to a quantity of *phlogiſton* preſent; *which* phlogiſton is prevented from *arranging* itſelf around any *one particle*, by the *equal* attraction, of *two* or *more* particles, to which it hath an *equal affinity*, and which are therefore firmly united, by that attraction to the *phlogiſton* interpoſed between them.

If the quantity of phlogiſton be *greater*, the force of coheſion will be *leſs*; but on account of the equal attraction of every particle of the earthy principle, to the phlogiſton, and the *ſtrong* attraction of *arrangement*, exiſting between thoſe phlogiſtic particles, by reaſon of their *nearneſs* to the exciting particles of earth, their arrangement will be imperfect around the earthy baſes: and that force of attracting each other to arrangement, *ſufficiently great*, to produce that *ſlighter combination* or *union*, between *neighbouring particles*, which is called *fluidity*, on account of the *facility* with which the particles may be *moved*, from their ſituations, with *reſpect* to *each other*.

If the quantity of phlogiſton, as before mentioned, be *ſo great* as to form *complete* atmoſpheres, around each earthy particle, they become *elaſtic*, and take the form of *air*.

What hath been ſaid of the earthy principle and phlogiſton, in a ſimilar manner, takes place between the acidifying principle and æther.

The acidifying and earthy principles, are capable by interpoſition and mutual attraction, of fixing each other.

But it appears, that a particle of the acidifying principle, when poſſeſſed of a ſufficient quantity of æther, to form a complete atmoſphere, as in *pure air*, *loſes every appearance* of *acidity*; but when deprived of a certain quantity of that æther, ſo as to loſe its elaſtic form, and become a liquid, it *regains* thoſe properties, which we call *acid*; but even in this ſtate, it evidently retains *ſome æther*; therefore, it appears, that the *quality* which we call *acidity*, depends upon the *degree* of *excitement*, or *ſtate* of the *æther* ſurrounding a particle of the acidifying principle, as before mentioned. When the æther is *ſo abundant*, as to extend to a *great diſtance* around the acidifying centre, its excitement is *ſo ſmall*, as to have *no ſenſible* action. If a *part* of that atmoſphere be taken away, the *external particles* then expoſed to action, being *nearer* the centre, and *more excited*, ſhew their activity, by producing the *ſenſation* of *acidity*, and by readily *uniting* with alkaline *earths*, or *phlogiſton*; which are the *chemical characteriſtics* of acidity.

In like manner, a particle of the earthy principle, manifeſts the property of *alkalinity*, when the atmoſphere of *phlogiſton* ſurrounding it, is *not extenſive*, and conſequently is *much excited*; in which ſtate, it will *ſtrongly* attract *acids* and *æther*.

The acidifying principle, on account of its powerful attraction to the earthy principle, and to æther, can never be procured *intirely free* from *one* or *both:* neither can the earthy principle, be found free from acidifying particles or phlogiſton: by the *different* proportions of which, the *different* ſtates or degrees of *ſolidity*, and *fluidity* of *all bodies*, are produced.

Particles of the earthy principle therefore, are fixed particles of matter, actuated by a quantity of æther; if thoſe particles are not combined with particles of the acidifying principle, their ætherial atmoſpheres will attract ſurrounding phlogiſton in different proportions, producing atmoſpheres of different extent, and conſequently, of different degrees of excitement; and the properties produced by that degree of excitement, being thoſe we diſtinguiſh by the name of *alkaline*, muſt be greater, as the quantity of ſurrounding phlogiſton, and its diſtance from the earthy centre diminiſhes.

And a particle of the acidifying principle, being a fixed particle of matter, actuated by phlogiſton, will always be more or leſs completely combined either with the earthy principle or with æther.

If it be ſurrounded by a *large* atmoſphere of æther, the external particles being but little excited, will be ſcarcely active; but as the quantity of æther is diminiſhed, the particles nearer the centre, being more excited, proportionately manifeſt their activity; which, from its *effects* is called *acidity*. The degree of acidity or activity, of a particle of the acid principle, will therefore, be inverſely proportionate, to the quantity of æther ſurrounding it.

A particle of *earth* in proper circumſtances, or in a certain degree of heat, will *part* with its *phlogiſton*,

giſton, and all its *alkaline* properties, to combine with a particle of acid: which at the ſame time, will diſengage its *external ætherial atmoſphere*, and loſe its *acid* properties, to unite with the earthy principle, and form a ſolid compound, neither acid nor alkaline.

When particles of the earthy or acidifying principle are firmly united, by the interpoſition of a *ſmall quantity* of phlogiſton, or æther, they ſhew no appearance of *alkalinity* in one caſe, or *acidity* in the other; becauſe, the active principle interpoſed, being *equally* attracted by *each* ſurrounding particle of earth, or acid, is *prevented* from aſſuming *that atmoſpheric excited ſtate*, whoſe *properties* are diſtinguiſhed by the name of *alkalinity* in *earthy* matters, or *acidity* in the *other* principle.

The attraction of coheſion, or degree of ſolidity of all bodies, therefore, depends *either* upon the *proportion* of one or other, or both of the *active principles*, phlogiſton and æther, when combined with the two ſolid principles, the earthy and acidifying: or upon the union of the *two active*, or *two fixed* principles, *alone*. The *two fixed* principles together, or with a *ſmall* proportion of the active principles, produce the *moſt ſolid* and *ponderous* ſubſtances: with a *greater* proportion they form *liquids*: and with a *ſtill greater*, *aeriform fluids*; while the *two active principles*, by uniting, produce thoſe extremely ſubtile and elaſtic fluids, *Light* and *Fire*.

But, independant of the principles, of which bodies are compoſed, their ſtate of ſolidity, or power of coheſion, by which one particle attracts another, is liable to very great alterations, from cauſes, foreign to themſelves. Thus, ſolid ſubſtances, may be reduced to ſmall parts, by *mechanical* means: *acids*, *alkalis*, and many *ſaline* matters, may be *diſſolved* by means of *water*; and almoſt every ſubſtance in nature, undergoes ſome change in its ſolidity, ſtate of aggregation, or exiſtence, when expoſed to the action of *fire*. But, as *theſe laſt*, are only accidental changes, chiefly produced by the mechanical action of water, or fire, and which diſappear, and leave thoſe ſubſtances in their natural ſtate, when the water or fire is again withdrawn: I ſhall at preſent paſs over them, without further notice, and proceed to the next Section; in which, I ſhall endeavour to explain, the *power* or *property* of *Gravitation*, or the *univerſal attraction* of matter, upon the principles here delivered.

SECTION VIII.

On Gravity, or the Power by which diſtant Bodies attract each other.

'TIS very evident, that diſtant bodies have a power, by which they attract, or have a tendency to approach each other: that the ſun, the earth, and every planet in our ſolar ſyſtem, have a mutual tendency to, or attraction for each other; for were not the attraction for inſtance, betwixt the ſun and the earth, ſufficient to counteract

act the natural tendency of the earth, actuated by its given motion, to move in a right line, it would not be drawn from that line, ſo as to move in the nearly circular orbit, in which we know it does.

This attraction is called the attraction of *gravitation*, or the power, which if not counteracted, by the direct tendency of motion, would bring the earth into contact with the ſun, in the ſame manner, and from the ſame cauſe, as a ſtone raiſed on high, when left to itſelf, will fall, or be attracted to the earth.

To point out the laws, relative forces, and mathematical proofs of gravity, and its influence upon moving bodies, is not conſiſtent with my plan: they are already known; and 'tis ſufficient for me, that the exiſtence of an attraction, or gravitating power, producing a mutual tendency in all bodies to come into contact, is univerſally admitted: the attraction of the earth to the ſun, or the moon to the earth, is an inſtance in larger maſſes of matter; and the falling of a ſtone, or its being attracted ed to the earth, when removed from it, ſhews that the ſame property exiſts in ſmaller bodies.

But, as no body can act where it is not, 'tis evident, that *two diſtant* bodies can have no action upon, or attraction to each other, but by means of *ſomething* interpoſed; *that* ſomething we know is not air, fire, light, or any thing groſſer than theſe: it muſt therefore be ſomething elſe, more ſubtile and rare, even than they are.

Whatever this ſomething may be, 'tis evident, that it hath an univerſal attraction to matter: that it is extended from the ſun to the earth, to Herſchels planet, and moſt probably far as creation itſelf: that its power is excited by matter, and conſequently, that the quantity or degree of that power or the force of attraction, is in a compound ratio, to the quantity of matter, and nearneſs to the exciting body: and that it penetrates all bodies.

If two bodies have each of them radii of theſe attracting particles, extending from one to the other; each body muſt move towards the other, becauſe each ſucceeding particle of theſe excited intermediate lines of attracting particles, being *nearer* to the diſtant body, muſt be *more excited*, and attract with *greater force*, than the preceding more diſtant particle: conſequently, each body will be drawn towards the other; and the force and velocity will increaſe, as their diſtance decreaſes, till at length they ruſh into mutual contact; and as every ſolid particle of matter, is capable of giving an equal degree of excitement, to this active medium, 'tis evident, that a body compoſed of 100 ſolid particles, will attract with 10 times the force, of a body containing but 10; therefore, the lighter or ſmaller body, will move with 10 times the velocity, and conſequently, through 10 times as much ſpace, when attracting each other to union, as the heavier body will; as being only attracted, with one tenth of the force, with which it attracts the ſmaller body.

This attracting or gravitating power, muſt therefore be a ſubtile active fluid, whoſe particles attracting matter, are excited to attract each other, and form lines, or radii, ſurrounding the body in every direction.—What is it?—is it æther?—or is it phlogiſton, both of which in a ſimilar manner, attract matter and become actuated, ſo that their particles attract each other?—no—it cannot; becauſe the globe of the earth, equally attracts all bodies, whether they have atmoſpheres of æther or phlogiſton: it therefore cannot be æther, becauſe this gravitating power acts upon a particle ſurrounded with an ætherial atmoſphere; neither can it be phlogiſton, becauſe a particle of matter is equally attracted by it, to the earth, although inveloped by an atmoſphere of phlogiſton. But if it is neither æther, nor phlogiſton, what then is it? —— It is an effect ariſing from *both*, which when excited, *attract each other*; and by that means, the *ſolid bodies*, to which they are connected, and by which they are excited; and is effected by the ſame general laws, by which a particle of the earthy principle, with its ætherial atmoſphere, attracts a particle of the acidifying principle, with its phlogiſtic atmoſphere; two atmoſpheres of the two different fluids, in a ſimilar ſtate of excitement, attracting each other, from one centre to the other, and forming contiguous lines of particles,

cles, whoſe *only property* is, that of *attraction*; by which, they *draw* their reſpective centres together.

If then an atmoſphere of æther, uniting with another of phlogiſton, have the property of *drawing* the two ſolid centres which they ſeparately ſurround, forcibly into *contact*, in a *direct line*: in that ſtate of combination, they muſt be arranged in lines, extended from one ſolid centre to the other: and be poſſeſſed of the very properties, which produce the phenomena of attraction, or gravitation. But the *effects* being the *ſame*, the *cauſes* muſt be ſo too; conſequently, the *active power*, which *attracts all bodies*, and *draws* them *to each other*, is no other, than the attraction of *combination* of the two active principles, *æther* and *phlogiſton*; which being *excited*, by attraction to ſolid bodies, ſo as to form right lines, extending in every direction, to all diſtances, thoſe radii of *different kinds*, will *attract*, and *draw each other* into *parallel* lines, immediately extending from one ſolid centre to the other; *which centres*, by thoſe *attractive lines*, will alſo be *drawn towards each other*.

It appears therefore, that *æther* and *phlogiſton*, are the two ſubtile, active principles of nature, equally expanded, far as the univerſe extends, and equally preſent in every part of Creation. By their *equal* attraction to fixed matter, and power of inſinuating themſelves into the *interſtices*, or *ſpaces* left between the atmoſpheric lines ſurrounding fixed particles, they become *gently excited*: ſo that every ſolid body, of whatſoever kind, will communicate a *certain degree* of excitement, to *one* or *other* of theſe ſurrounding fluids; *which* by that attraction, becoming active, will attract the particles of the *other* kind, excited by *another body*; in conſequence of which, thoſe *two diſtant bodies* will be *drawn* in a right line, *into contact*.

'Tis well known, that the gravity, or weight of any body, is not always in proportion to its ſurface, but to the quantity of matter it contains: therefore, the active fluids, are capable of *permeating every* ſolid body, and of receiving a certain gentle excitement, from *every particle* of either, or both of the *fixed principles*, forming the baſes of thoſe ſolid bodies: conſequently, the greater the number of fixed particles contained in any body, the greater will be the number of excited lines of active particles, extending in every direction, from that body: and the greater muſt be its force, or power of attraction, when *thoſe* radii, meet with *others* of the oppoſite kind, extending from ſome other exciting body.

Since then, the ſpecific gravity of any body, is proportionate to the number of ſolid particles compoſing it, it is natural to conclude, that *every* particle, of either of the *ſolid principles*, is capable of giving this moderate degree of excitement, producing gravitation, either to æther, or to phlogiſton: that 'tis highly probable, that the ætherial atmoſphere, eſſential to a particle of the earthy principle, gives this excitement to the diſengaged phlogiſton ſurrounding it: and that the phlogiſtic atmoſphere, eſſential to the acidifying principle, excites æther; conſequently, when theſe ſlightly excited atmoſpheres of æther and phlogiſton, come into contact, they will attract each other, and draw their reſpective centres, together; and any ſmaller body, will be forcibly drawn to another much larger, compoſed of both the fixed particles, as for inſtance, a ſtone to the earth, becauſe of whichever kind the atmoſphere of the ſmaller body may be, it will meet with an infinite number of lines of particles of the oppoſite kind, extending from the larger maſs of particles, by which it will be moſt powerfully attracted.

Æther and phlogiſton therefore, are univerſally diffuſed, and every particle or every maſs of fixed matter, gives to one or other, or both of them, ſome excitement: the conſequence of that excitement is, an arrangement in right lines of ſimilar particles; and a line of particles of *one* kind, extending from *any* body, meeting with a ſimilar line of particles of the *other* kind, excited by *another* body, will attract and be attracted by thoſe particles, in a progreſſive motion from the particles more diſtant, or leſs excited, to thoſe more excited, and nearer to the diſtant body, till at length, the oppoſite or exciting centres, are drawn together.

A fixed particle of matter, ſurrounded by an atmoſphere of æther, or of phlogiſton, ſo as to become a particle of the earthy, or acidifying principle, may without any interruption excite the phlogiſton, or æther every where preſent, ſo as to enable them to produce the phenomena of gravity: becauſe, æther, or phlogiſton, *ſtrongly* excited by the fixed central particle, can have no power of uniting *with*, or diſturbing the arrangement *of* phlogiſton or æther, in this *ſlighter* ſtate of excitement; no more than an atmoſphere of the *electric* fluid, can interrupt, or deſtroy the arrangement or power of a *magnetic* atmoſphere; both of which attractive powers we know may exiſt in full force, at the ſame time, in the ſame needle; for if a magnetic needle, be electrified, it will ſhew all the phenom ena, of *electrical* attraction and repulſion, that another needle, not magnetic, will, in the ſame circumſtances: and at the *ſame time*, it will attract or repel another magnet, and ſhew, that it is ſtill poſſeſſed of its *magnetic* power of *attraction*.

'Tis evident therefore, that the globe of the earth, and every large maſs of compound matter, being ſurrounded by the *æther* and *phlogiſton univerſally diffuſed*, and being compoſed of both the fixed principles, will excite that æther and phlogiſton, to arrangement in right lines: that thoſe ætherial, and phlogiſtic lines of particles, will like *radii*, extend, *diverging* as they recede from the earth as a centre, to the *moſt diſtant* parts of *creation*, unleſs they meet with lines of phlogiſtic, or ætherial particles, in a ſimilar ſtate of excitement, from ſome other maſs of matter; for inſtance, the ſun; in which caſe, the lines of phlogiſtic and *ætherial* particles, excited by the earth, will attract the ætherial and *phlogiſtic* lines, from the ſun; and by that union, would *draw* their reſpective centres, the earth and ſun *into contact*: did not the direct tendency of the earth's motion, and the force or degree of that motion, counteract the power with which the ætherial and phlogiſtic rays of particles, by their mutual attraction, draw them to each other; and in the ſame manner, the attraction of the earth to the moon, and between leſſer maſſes of matter muſt be accounted for; as well as the attraction of a particle of the earthy, to a particle of the acidifying principle.

We may conclude therefore, that the *attraction* of univerſal *gravitation*, is the *ſame*, as the attraction between an acid and an alkali; and that *both* are produced by the *ſame cauſe*, the attraction of *excited* particles of *æther*, to particles of *phlogiſton*, in a *ſimilar* ſtate of excitement: that æther and phlogiſton are *univerſally diffuſed*, and *every where* preſent, and are, capable of being *ſo much excited*, by the fixed principles of either kind, as to become *atmoſpheric*, and *attractive* to *each other:* and that when they come *into contact*, in that ſtate of excitement, by their affinity to each other, they progreſſively *unite*, and form *lines* of particles, ſtrongly *drawing* the *ſolid centres*, around which they are excited, into *contact;* becauſe, the *next* approaching particles of æther, or phlogiſton, being *nearer* to their reſpective centres, than the *preſent* particles, will attract with *more* force, than they do; conſequently, the ſolid centres will be drawn together, with a force increaſing, as their diſtance diminiſhes, till they are brought into contact; where they will remain *firmly united*, as neither of them, on account of their ſolidity, can penetrate the other.

This *progreſſive attraction* of *combination*, therefore, of the *two active* principles, *æther* and *phlogiſton*, forms that attractive power called *Gravity*, or the *attraction* of *gravitation*; by which, *every* part of nature, is *connected* with *every other* part; forming *that whole*, whoſe beauty, order, and harmony, ſtrike us with wonder and admiration!

PATENT OFFICE LIBRARY

SECTION IX.

On Magnetiſm.

MAGNETISM is that property peculiar to *Iron*, by which one particle or maſs of it, is capable of attracting, or forcibly uniting with another. This magnetic virtue, is capable of acting at a *conſiderable diſtance:* but the greater the diſtance, the leſs the force, or power of attraction.

This property depends upon the *principles* of which iron is compoſed, and *their proportions*; for if it be decompoſed, or deprived, to a certain degree of its phlogiſton, and acquires a certain addition of the acidifying principle in its place, it is no longer capable of magnetic influence.

If a piece of iron be *magnetic*, it hath a general attraction to iron *not* in the ſame magnetic ſtate; but if two bars, or needles of iron, be magnetic, they will not attract each other, unleſs one of them be *inverted*.

A magnetic needle, when not interrupted, will always arrange itſelf, with *one certain end* to the *north*, and *the other* to the *ſouth*.

If another needle not magnetic, be applied in the ſame direction, with *its ſouth* end, to the *north* end of the *excited* needle, it will be attracted, and in conſequence of that attraction, will become magnetic; ſo that when ſeparated, *that end*, which was applied to the north pole of the other, will ſtill point to the ſouth; and conſequently, the further end to the north. Or if it be applied to the ſouth pole of the magnetic needle, it will ſtill acquire the magnetic virtue, and that end which touched the ſouth pole, will point to the north.

If two magnetic needles be ſuſpended, ſo as to have freedom of motion, and the north pole of one be brought near to the ſouth pole of the other, they will attract each other at a conſiderable diſtance, and mutually ruſh with accelerating force, and velocity into contact; but as two needles, *cannot* act upon each other at a *diſtance*, when *not magnetic*, 'tis evident, that this attractive property, muſt depend upon *ſome other principle* or *active fluid*, ſurrounding the needle in an *atmoſpheric* form, when *magnetic*.

This magnetic fluid therefore, is an atmoſphere of active particles, ſurrounding the excited pole, and attracting, or drawing towards it, with a certain force, any particle or particles of iron, within a certain diſtance.

If the *north pole* of an *excited* needle, therefore,

be

be brought near another needle *not* excited, it will draw it to it: but, if *that north pole*, be brought near to the *north pole* of *another* excited needle, they will *not* approach, but *recede* from each other; the ſame if two ſouth poles, be brought near each other. We have then a *magnetic needle*, whoſe north pole will attract *either end* of a needle *not excited*, with a certain force: which will attract the *ſouth pole* of an *excited* needle, with a ſtill greater force, and to a much greater diſtance: but which will *not attract*, or come near to the *north pole* of an *excited needle*; though *that* north pole itſelf, will attract an unexcited needle, in the ſame manner as the other north pole will.

'Tis evident therefore, that *each pole* of a magnetic needle, is ſurrounded by an *atmoſphere* of magnetic fluid: that *each atmoſphere*, hath an *equal* attraction to iron in general: that the atmoſphere ſurrounding the *ſouth* pole, will ſtrongly attract the *north* pole of another magnet: but that the atmoſphere ſurrounding the *north* pole, will not come near, but *recede* from the *north* pole of the *other* magnet; conſequently, the atmoſphere ſurrounding the *north* pole, muſt be a fluid, *different* from that, inveloping the *ſouth* pole, though ſimilar in its attraction to iron, and power of aſſuming an atmoſpheric form.

It appears therefore, that ſimilar atmoſpheres will not approach, but that oppoſite atmoſpheres, will forcibly unite, and attract each other: that the pole of *every* excited needle, pointing to the *north*, hath a *ſimilar atmoſphere*: as have all thoſe pointing to the ſouth: but that the atmoſphere of the *north* pole, is a *different fluid*, from that, actuating the *oppoſite pole*, of every *magnetic* needle.

The magnetic fluid is therefore of *two different kinds*; or rather, *two different fluids* when rendered active, by excitement, are capable of forming themſelves into *atmoſpheres*, around certain particles of *iron*, by *which* excitement, they become *attractive* to *iron* and to *each other*. Theſe *two active ſubtile fluids*, being exactly *ſimilar* in their properties, to *æther* and *phlogiſton*, can be no other; therefore, if the *north pole* of a *magnet* be ſurrounded by an atmoſphere of *æther*, the *ſouth pole* muſt have an atmoſphere of *phlogiſton*.

The natural compoſition of iron is ſuch, that it ſtrongly attracts around it, a conſiderable quantity *both* of æther and phlogiſton: if by any means, ſuch as a ſmart ſtroke upon one end of a needle, or an electrical ſhock paſſing through it, either the phlogiſton or æther be *peculiarly excited*, at *that end*, it takes an *atmoſpheric form* around it; and the *other* active fluid, will immediately aſſume a *ſimilar* active ſtate of arrangement, around the *other end*; in conſequence of which, the needle will become *magnetic*; *one* atmoſphere or pole pointing to the north, the *other* to the ſouth.

If the end of another needle, *not excited*, be applied to the north pole of this *excited* needle, if that excited pole be ſurrounded with *æther*, it will attract the *phlogiſton*, naturally ſurrounding the *unexcited* needle, to *that end* which is applied to it; *which phlogiſton*, by that attraction, will become *excited*, and take an *atmoſpheric form:* while the *æther*, being diſengaged, becomes *equally excited*, arranges itſelf around the *oppoſite end* of the needle; by which it becomes magnetic alſo; its ætherial atmoſphere always pointing to the north, and the phlogiſtic pole to the ſouth.

The north and ſouth poles of two magnetic needles, will attract each other, and unite; becauſe, one hath an ætherial atmoſphere, and the other a phlogiſtic one; therefore, they will penetrate each other, unite, and deſtroying each other's regular arrangement, will form *lines* of attracting particles, *drawing* their reſpective poles into *contact*, in the ſame manner, as when by a *more moderate excitement*, *they* produce the attraction of *gravitation*, or tendency to unite between other bodies.

But two *ſimilar* atmoſpheres of æther or phlogiſton, ſurrounding ſimilar magnetic poles, *cannot* penetrate or unite with each other, as having *no attraction*, but that of arrangement; conſequently, thoſe atmoſpheres will *preſs upon*, and *reſiſt* each other; having no power to leave their reſpective centres, or poles, round which they are excited to arrangement.

The *two poles* of a magnet therefore, very much reſemble the *two fixed principles* of nature, the earthy and acidifying particles; if the ætherial pole of a magnet, be that which always points to the north, like a particle of the earthy principle, it will be a centre of *fixed matter*, with an *ætherial* atmoſphere; and the ſouth pole, will be like a particle of the acidifying principle, a *fixed* centre, with an atmoſphere of *phlogiſton*; the fixed centres being the *ſame*, in each pole, or each fixed principle: and their peculiar properties, produced by the *active atmoſpheres* around them.

The north and ſouth poles readily, and forcibly attract each other: ſo do the earthy and acidifying principles.

Two *ſimilar* poles will *not* attract each, other: neither will two particles of the *ſame* fixed principle.

Two ætherial, or north magnetic poles, may be made to unite, if a phlogiſtic, or ſouth pole be brought between them: ſo two ætherial, or earthy particles, will unite, if phlogiſton, or a particle of the acidifying principle with a phlogiſtic atmoſphere, be introduced between them.

Indeed, the properties of a particle of the earthy and a particle of the acidifying principle, and their relation to each other, ſo *ſtrongly reſemble* the properties of the *two contrary poles* of a magnet, and their relation to, and influence upon each other, that there can be no doubt, that both depend upon the *ſame cauſes*, and that *thoſe cauſes*, are the *two active principles*, *æther* and *phlogiſton*, which being excited to arrange themſelves like atmoſpheres around them, as centres, give the properties of the earthy or acidifying principles to fixed particles of matter, and the *polarity* of *magnetiſm*, to the poles of the needle; the pole ſurrounded by one active fluid, always pointing to the north, while the pole ſurrounded by the other, as conſtantly points to the ſouth; in the ſame manner, as a particle of fixed matter ſurrounded by æther, acquires the properties of the earthy, and a ſimilar particle, with an atmoſphere of phlogiſton, acquires the properties of the acidifying principle,

ſtrongly

ſtrongly tending to combine with the earthy principle, as the north pole of a magnet, ruſhes into contact with the ſouth.

Magnetiſm, and all its phenomena therefore, depend upon the two active principles, *æther* and *phlogiſton*; which, by the peculiar nature of *iron*, which they naturally ſurround, are capable *either* of them, *ſingly*, of becoming *excited* to ſuch a degree, as to ſurround one end of a needle, or bar, like an *atmoſphere;* but which ever of the two active fluids is ſo excited, the *other* by ſeparating from its common union with it, becomes excited alſo, and ſurrounds the oppoſite end of the needle; which being robbed of its natural quantity of the *other* fluid, attracted and excited to the other end, ſtrongly attracts *this other fluid* into an atmoſpheric form alſo; ſo that a bar of iron, hath a *natural quantity* of the two active principles, equally diffuſed around it. If one of thoſe fluids, for inſtance *æther*, be excited at *one end* of a needle, it will attract into arrangement, *all* the particles of *æther* naturally ſurrounding that needle, and form an atmoſphere around that end; and in this ſtate of excitement, it attracts the needle with *more force*, than it does phlogiſton: therefore, the phlogiſton being diſengaged, will become *equally* excited, and form a *ſimilar* atmoſphere around the other end; and the needle thus having *all its æther* at one end, and *all* the *phlogiſton* ſurrounding the other, will become *magnetic*; that is, ſimilar poles, or poles ſurrounded with atmoſpheres of the ſame kind of fluid, *cannot* attract or come near each other: but a north and ſouth pole, of two magnetic needles, having atmoſpheres of the *different fluids*, one being ætherial and the other phlogiſtic, will attract, and be *drawn* forcibly to each other. *Either* of theſe atmoſpheres will attract iron, on account of the oppoſite principle naturally ſurrounding it; but if either of theſe excited poles, ſuppoſe the *ætherial* one, be applied to the end of a needle, of *unexcited iron*, the æther will attract *all* the *phlogiſton* naturally belonging to the non-magnetic needle, to that end; in conſequence of which, the *æther*, naturally attending the phlogiſton attracted by the magnetic pole, will *recede* to the *other end* of the needle; therefore, *each* being excited, will form *atmoſpheres*, around their reſpective ends;

and this needle alſo, will be a *magnet;* that end by which it was excited, always having an atmoſphere of the *oppoſite fluid*, to that of the magnetic pole applied; and conſequently, pointing in a *contrary direction*.

The reaſon why the two different atmoſpheres of a magnetic needle, will not unite ſo as to *ſeparate* from their fixed centres, ſince they have ſo great an affinity to each other, is owing to the *degree* of their *attraction* to their reſpective poles of iron, being *greater*, than the force of attraction for each other; as is evident, from this, that though the north and ſouth poles of two magnets will forcibly unite, yet if drawn aſunder, the ætherial and phlogiſtic atmoſpheres will *part* with *each other*, rather, than from their exciting poles of the needles; in like manner, the æther around one pole of the needle, will attract the phlogiſton around the other, but that attraction is not ſo great, as the attraction to the poles of the needle, therefore they will not *leave* their reſpective poles; but their attraction to each other, will *deſtroy* the *regularity* of their *arrangement:* thoſe particles being

ing *moſt* deranged, which are the *moſt oppoſed* to the contrary atmoſphere.

It appears therefore, that a needle, in its common ſtate, hath the *ſame quantity* of æther and phlogiſton ſurrounding it, as when excited; and that the *only difference* is, that in the *natural* ſtate, the æther and phlogiſton are *promiſcuouſly* and *equally* united, on every part of the ſurface: but when that needle is *excited*, ſo as to become magnetic, *all that* natural quantity of *æther*, is collected and intimately attracted to *one end*, and *all* the *phlogiſton* to the other; and that this is in reality the caſe, every property of the magnetic needles corroborates, and the following circumſtance ſufficiently proves. If an iron rod, of *conſiderable* length, and thickneſs, be rendered magnetic at one end, it will be magnetic to the other; ſuppoſe that the *excited* end hath an atmoſphere of *æther*, and will attract the *ſouth* end of an *horizontal* magnetic needle, at the diſtance of *three inches:* if it be moved, nearer to the needle, *upwards*, in a perpendicular direction, it will attract that ſouth end, for *three inches* of its length; therefore, the ætherial atmoſphere, is *ſix inches* in diameter; three inches from the end, or pole, each way. If the rod be ſtill moved upwards, the *north* end of the magnetic needle will become attracted, which ſhews, that *then* the *phlogiſtic atmoſphere* commences: and the ſame *north pole* will be attracted, till *ſix inches* of the rod paſs by it; which ſhews, that the phlogiſtic atmoſphere extends ſix inches alſo, that is, three inches each way, from its centre or pole. If now the rod be ſtill moved upwards, the *ſouth pole* of the needle will be *again attracted*, as at firſt; which proves, that the *ætherial* atmoſphere *again* commences, and extends *ſix inches* as before.

But, if a *ſmaller rod* be employed, the *extent* of thoſe atmoſpheres, will be *leſs*; and conſequently, the *poles*, or *centres* of thoſe atmoſpheres, will be *nearer* to each other.

But a magnet in vacuo, will render a needle magnetic, without loſing any of its own power; conſequently, the needle acquires *no* additional principles; and its acquired magnetic power is produced, by its naturally ſurrounding fluids, being

ing ſeparated, and becoming atmoſpheric, *one* at *one* of its *ends*, and the *other* at the *other;* and the *greater* the *ſurface* of the needle, the *greater* muſt be the *quantity* of thoſe fluids, naturally ſurrounding it; and therefore, the *more extenſive* will be the *atmoſpheres*, formed by thoſe fluids, the æther and phlogiſton, when excited to the *magnetic* arrangement; and the *more diſtant* muſt be their poles.

Whatever can deſtroy this arrangement, as a ſmart ſtroke, an electric ſhock, the action of fire, or the decompoſition of the iron, immediately deprives the needle of its magnetic properties, which, in all caſes may be recovered, by the touch of a magnet; except, when the iron is decompoſed; in which caſe, it is incapable of magnetic excitement, unleſs its principles, and their proportions be reſtored as at firſt; without which, it cannot give that excitement, and attraction to the ſurrounding æther and phlogiſton, which conſtitute the magnetic power.

The reaſon why a magnet will attract no other ſubſtance but iron, is becauſe no other body compoſed of *different principles*, or of the ſame principles in *different proportions*, hath ſo ſtrong a natural attraction to *both æther* and *phlogiſton*, as *iron* hath; therefore, if the ætherial pole of a magnet, be brought near to another body, although ſurrounded by phlogiſton, it will *not* attract *that body*, unleſs *it* attracts its phlogiſton ſo as to give it an *excitement*, *ſimilar* to the magnetic ſtate, or ſo *ſtrongly*, that it *will not part* with it; in which caſe, the ætherial pole of the magnet, attracting the phlogiſton, muſt draw the body along with it alſo; but no other ſubſtance can be attracted by the magnet: therefore, *no other body* is ſo *powerfully attractive* to ſurrounding *æther* and *phlogiſton*, as *iron* is; and conſequently, can neither be attracted by the magnetic atmoſpheres, nor become magnetic.

For if iron, in its natural, or in its magnetic ſtate, gives to *æther* or *phlogiſton* a *much more powerful excitement* than *other bodies* do, as appears from the power of magnetic attraction: 'tis evident, that the *weaker* excitement given to them, by *other bodies*, will *not* enable *either* of them, in that ſtate, of ſlight excitement, and weak *attraction* of *union* to its oppoſite, to overcome the *ſtronger* attraction of *arrangement* in this *magnetic ſtate*, of *great excitement*; conſequently, the *magnetic arrangement*, will not give way to the *feeble* attraction of *any other* ſtate of excitement, around *any other* kind of matter whatſoever, having *leſs* attraction to æther and phlogiſton, than *iron* hath.

Having now examined *æther* and *phlogiſton*, in *two different* ſtates of excitement, forming atmoſpheres around ſolid bodies, as centres; in the *ſimpler* ſtate of excitement, producing the *attraction* of *Gravity:* and when *more ſtrongly* and peculiarly excited by the attraction of iron, producing the *attraction* of *magnetiſm;* it next follows, to conſider the *third ſtate* of their excitement, in which, they are capable of taking an *atmoſpheric* form, around their exciting bodies, producing the *third* kind of *attraction*, that of *electricity;* which will form the ſubject of the enſuing Section.

SECTION X.

On Electricity.

ELECTRICITY is that ſtate, or property communicable to bodies, by which they attract, or repel each other, according to circumſtances; independent of either gravity or magnetiſm. Every appearance therefore of attraction, or repulſion, which is not the effect of either gravitation or magnetiſm, is produced by *Electricity.* But as bodies by means of electricity, are capable of acting upon each other, at a conſiderable diſtance: 'tis certain, that all the phenomena of electrical attraction or repulſion, are produced by ſome ſubtile active medium, extending from the excited body, to the body acted upon; and that active medium, is univerſally called the *Electric fluid.*

If *glaſs* be excited by friction, it will acquire an atmoſphere of this electric fluid, which will attract a light ball of cork, or any other ſubſtance ſuſpended by a ſilk thread, at a conſiderable diſtance; and drawing it to itſelf, will communicate a ſimilar atmoſphere of electric fluid, to the cork; in conſequence of which, it will be repelled; which ſhews, that the *electric atmoſphere* of the glaſs, hath a general attraction to all unexcited matter, by which it draws it to the excited glaſs: that the body, by that attraction brought to the ſurface of the glaſs, becomes ſurrounded by that electric atmoſphere, unites to a part of it, and is then repelled; and conſequently, that *two bodies,* poſſeſſed of the *ſame electric* fluid, acquired from the excited glaſs, will repel each other.

If a piece of *ſulphur* be rubbed, it acquires an atmoſphere of electric fluid, which in like manner, will attract a cork or other body, and then repel it; therefore, the *electric fluid* excited by means of *ſulphur*, hath an attraction to all unexcited bodies; and *two bodies* ſurrounded by it, will repel each other.

Two balls therefore, ſurrounded by atmoſpheres of electric fluid, excited by *glaſs*, will *repel* each other; ſo will two balls electrified by means of *ſulphur*. But *a ball* electrified by excited *glaſs*, will *attract* a ball electrified by means of excited *ſulphur;* and every appearance of electricity will vaniſh, in the form of light, accompanied with a ſnapping noiſe: conſequently, the electric fluid produced by exciting *glaſs*, is *different* from *that* produced from *ſulphur;* becauſe, they forcibly *attract*, *unite*, and *deſtroy each other's electric properties:* therefore, they are two different fluids of different properties: each capable of being excited, and of attracting, and ſurrounding all bodies like atmoſpheres: in which ſtate, neither of them can unite with, or come near to bodies poſſeſſed of ſimilar atmoſpheres: but, atmoſpheres of the two different fluids, will attract, unite, and by uniting, *deſtroy* thoſe electric properties, which each had when ſeparately excited. It appears therefore, that their attraction to each other, is greater than their attraction to the bodies by which they are excited, or round which they take an atmoſpheric form: that they poſſeſs the properties of attraction or repulſion, which we call electric, when excited ſingly: but, when they unite, every electric property ceaſes, they ſeparate from their exciting ſurfaces, and light or fire is produced, metallic calces may be revived by acquiring *phlogiſton* from them, and the acid principle become pure air, by their ſupplying it with *æther*. Theſe things conſidered, and their attraction to matter, their atmoſpheric arrangement, the inability of ſimilar atmoſpheres to coaleſce, and the attraction and union of the two different kinds of atmoſpheres, being ſo exactly ſimilar to the two active fluids, æther and phlogiſton, leave no room to doubt, that they are the *ſame principles*, rendered active, or having acquired the properties which we call *electric*, by a certain mode or degree of excitement.

citement. For, if metals contain *phlogiſton*; and pure air *æther*, which I think I have ſufficiently proved, then the union of the two electric fluids producing a ſpark, which is compoſed of both æther and phlogiſton: and *that* electric ſpark being produced by the union of the two oppoſite electric fluids, which in their ſeparate electric ſtates, poſſeſſed different properties: one of them *muſt* have been *ætherial*, and the other *phlogiſtic*; therefore, poſitive and negative, or vitreous and reſinous *electricity*, are no other than *æther* and *phlogiſton* ſeparately, in that ſtate of excitement which we call electric.

But, if *glaſs* be excited by means of a rubber, the electricity of the glaſs will be oppoſite to that of the rubber: that is, the one will poſſeſs æther in an elctric ſtate, and the other phlogiſton.

If the *inſide* of a jar, properly coated, be connected by means of ſuch bodies, as readily conduct the electric fluid, with the excited glaſs, and the *outſide* coating of the jar, be connected with the rubber, the jar will acquire a quantity of the *ſame* kind of electric fluid as the excited *glaſs*, on its *inſide* ſurface: while the *outſide*, will become electric by the contrary fluid, the ſame as the *rubber*; one ſide having the ætherial electricity, and the other the phlogiſtic.

If a conductor, or ſubſtance of any kind, be ſurrounded by an atmoſphere of either ætherial, or phlogiſtic electricity, that atmoſphere will attract any other body, which, if light will be drawn to it, and then repelled; and it will have *equally* the *ſame effect*, if a piece of *glaſs* be *interpoſed*, between the excited body and the body attracted; which fully proves, that either the ætherial, or phlogiſtic electricity, *readily penetrates glaſs*, and loſes none of its electric properties; ſtill attracting, and then repelling the light body, the *ſame* as when *no glaſs* is interpoſed.

Again, if the *inſide* of a coated jar, communicates with an exciting body, while the *outſide* is *inſulated*, or not connected by conducting ſubſtances with the rubber, the electric fluid produced by the globe, will *diffuſe* itſelf over the inſide of the jar, but will *not unite* with it, ſo as to *charge* it; but is looſely expanded upon the ſurface of the coating, forming an atmoſphere in the ſame looſe ſtate, as that ſurrounding the conductor; which keeps flying off from the ſurface, or ſome edge, point, or corner, as faſt as it is generated by the globe; the form in which it eſcapes, is that of *light*, accompanied with a hiſſing noiſe, and phoſphoreal ſmell.

But, if the *external* coating of the jar, be connected by conducters to the *rubber*, the electric fluid thrown into the jar, will become *fixed*, and *condenſed* there; and the jar will be *charged*; while the *outſide* will be equally charged, with the *contrary* kind of electric fluid. Here again, the action of *either* or both of the electric fluids, *through glaſs*, is evident; for by their attraction to each other, they become *fixed* to the *oppoſite ſurfaces* of the *glaſs*: though neither of them could fix to it, when *not attracted* by the *contrary fluid*, on the *other ſide*.

If a communication be made, by means of conductors, between the two oppoſite ſurfaces of the jar, the two fluids will ruſh into union, with violence and noiſe, and produce *fire* or *light*; by which, both the fluids loſe their electric properties.

But if the two oppoſite electric fluids, have a greater attraction to each other, than to the ſurfaces on which they are excited, and each of them is capable of readily penetrating glaſs, what is the reaſon, why, when excited, one on each ſurface of the jar, they do not attract each other through the glaſs and unite; in the ſame manner, as they would through an equal, or much greater thickneſs of metal?

But if, as is certainly the caſe, the electric *ætherial* fluid be on one ſide the glaſs, and the electric *phlogiſtic* fluid on the other ſurface: and each acts through the glaſs, ſo as by its attraction to the oppoſite fluid on the other ſide, to become fixed and condenſed on its reſpective ſurface: the reaſon why they do not ruſh into union through the glaſs, muſt be, that *each fluid* is as much attracted by *ſome other* matter, with which it is combined, as it is by the *oppoſite* fluid on the other ſide the glaſs. It is not the oppoſite ſurfaces of the glaſs that attracts them, becauſe, they will leave thoſe ſurfaces, to ruſh into union; it muſt thereſore, be *ſome fluid* of ſome kind or other, by which *each* is attracted ſo *ſtrongly*, as to be *prevented* from paſſing through the glaſs, to unite with its oppoſite.

What is this other fluid? —— we know that when either a globe of glaſs, or ſulphur is excited, or when *either* the electric ætherial, or phlogiſtic fluid is copiouſly produced, that it appears *luminous*, or eſcapes in the form of *light*.

But light we know will communicate phlogiſton to metallic earth, and æther to the acid principle, and is therefore compoſed of *æther* and *phlogiſton;* conſequently, as light is always compoſed of the ſame principles, the light produced by the excited electric fluid, when eſcaping from the exciting globe, whether the fluid be of the negative, or poſitive kind, ſhews, that *each* of the *two oppoſite electric*

electric fluids, is compoſed of *both æther* and *phlogiſton*: and conſequently, the *poſitive* or *negative* ſtate; depends upon *which* of the two active principles, is *excited* by the *ſurface* of the globe, and *which* forms the *external atmoſphere*.

Sulphur we know, contains much *phlogiſton*, which when excited by a ſufficient degree of heat, readily attracts the æther from pure air, with which it will unite and fly off in the form of fire or light; we may therefore naturally ſuppoſe, that when *ſulphur* is *excited gently* by friction, it will attract the *æther* excited on its ſurface by that friction; for æther as well as phlogiſton, are always, and every where preſent, in ſome ſtate or other. But, ſince the phlogiſton of the ſulphur, *cannot* in the moderate degree of heat produced by this friction, *ſeparate* from its chemical union with the other principles, with which it is combined to form ſulphur: neither can it enter into chemical union with the ſurrounding æther; the conſequence of their excitement therefore will be, that the *æther* will be attracted by the *phlogiſtic ſurface* of the *ſulphur*, and aſſume an *excited atmoſpheric* form.

But the *phlogiſton* which was *naturally* preſent, and united to that æther, becomes *equally excited* by that friction; and being *diſengaged* from the æther attracted by the ſulphur, becomes as powerfully *attracted* by, and united to the *ſurface* of the *rubber*; but yet, the excited æther and phlogiſton, being in contact, ſtrongly attract each other, as is natural to ſuppoſe, from their ſtrong affinity; and as is ſufficiently evident, by the attraction ſubſiſting between the globe and the rubber. But, when by the rotation of the globe, or progreſſive motion of the rubber, their excited ſurfaces muſt ſeparate from each other, the *æther* excited by the globe, not being able to enter into chemical union with it, will attract along with it ſome *phlogiſton*, which will ſurround it in an *atmoſpheric* form; and the excited *phlogiſton*, forced over the edge of the rubber, will take along with it an atmoſphere of *æther*, and retreat to the back of it; at the ſame time, the other parts of the rubber, deprived by this excitement of their natural quantity of æther and phlogiſton, attract thoſe principles from the ſurrounding bodies, to which they are connected by proper conductors; for if the rubber cannot acquire phlogiſton and æther, in their natural ſtate of union from ſurrounding bodies, no electric fluid can be produced, more than juſt that quantity of æther and phlogiſton will afford, which naturally ſurrounds the globe and the rubber; becauſe, the principles will be wanting, which become electric by being excited by friction.

When a *globe*, or ſtick of *ſulphur* therefore, is excited by friction, ſo as to attract *æther*, that æther will attract an atmoſphere of *phlogiſton*, which will exhibit all the phenomena of *negative electricity*; while the *rubber*, poſſeſſed of excited *phlogiſton*, with an *external atmoſphere* of *æther*, will be *poſitively* electried.

But, theſe electric ſtates, of the excited ſulphur and its rubber, are directly oppoſite to thoſe of *glaſs* and the rubber, by which it is excited: therefore, *glaſs* by excitement attracts *phlogiſton*, which being equally excited, attracts an atmoſphere of *æther* around it; acquiring by that arrangement, the properties of *poſitive electricity*. And at the ſame time, the *æther* diſengaged from its union with the phlogiſton attracted by the glaſs, will become excited to the ſurface of the *rubber;* and when by the motion of the globe, the excited glaſs ſeparates from the edge of the rubber, the excited *æther* of the *rubber*, will attract around it, and take along with it, the *phlogiſton* ſeparated from the *external* atmoſphere of æther, ſurrounding the phlogiſton attracted by the ſurface of the globe, and flowing over the edge, will recede with it to the back of the rubber.

The whole of *electric* excitement then, is ſimply this, *æther* and *phlogiſton* in a certain *natural* ſtate of union, univerſally exiſt; when theſe are excited by friction, between the rubber and a globe of glaſs for inſtance, the glaſs having a greater attraction to *phlogiſton*, on account of the acidifying and æthereal principles entering into its compoſition, than to æther, by this excitement attracts ſome of it to its ſurface; and the *æther*, naturally combined with that portion of phlogiſton, being equally excited, will attract the ſurface of the *rubber;* when theſe excited ſurfaces part, the *phlogiſton* excited by the *globe*, will attract an *atmoſphere* of *æther*, from the remaining part of the compound of æther and phlogiſton naturally ſurrounding the rubber: and the *phlogiſton* diſengaged from *that æther*, will be attracted in an *atmoſpheric* form, around the excited *æther* of the *rubber*. The progreſſive rotation of the globe, carries theſe *electric atmoſpheres* along with it, by its attraction to the *phlogiſton* forming the *internal* atmoſphere; and the excited *atmoſpheres* of the *rubber*, at the ſame time, and by the ſame motion, are forced over its edge, and retreat to its back parts. The other parts of the rubber, thus deprived of their natural quantity of æther and phlogiſton, conſtantly attract it from every ſubſtance around; and ſo long as it is ſupplied with them, from the ſurrounding bodies, ſo long will the motion of the globe and rubber, by their mutual friction, excite thoſe principles, to take the ſtates of *poſitive electricity* around the *glaſs*, and *negative* around the *rubber*.

If the *inſide* of a coated jar, be connected by a conducting ſubſtance to the *excited glaſs*, and its *outſide* to the *rubber*, the *phlogiſton* with its *ætherial* atmoſphere, will paſs along the conductor, from the globe to the *inſide* coating of the jar: and the *æther* with its *phlogiſtic* atmoſphere, will paſs from the rubber, to its *outſide* coating; the *internal phlogiſton* on the *inſide* of the jar, attracting the *internal* atmoſphere of *æther* on the *outſide*, will *fix each other* to their reſpective ſurfaces; by which means, the quantity on each ſide, may be ſo accumulated, as to render the jar charged. In that ſtate 'tis evident, that the *inſide* of the jar, contains an atmoſphere of *phlogiſton* on *its ſurface*, ſurrounded by an atmoſphere of *æther*: and the *external* ſurface, hath an atmoſphere of *æther*, ſurrounded by another of *phlogiſton*. The atmoſphere of *phlogiſton* or the *internal* ſurface of the jar, cannot paſs through the glaſs, to unite with the *æther*, on the *external* ſurface, becauſe, it is *equally attracted* by the *æther ſurrounding* it, in an *atmoſpheric* form, in the *inſide* of the jar. But, if a quantity of *phlogiſton*, rendered electric by an atmoſphere of æther, paſſes into a jar, it will not *fix* itſelf to the inner ſurface of the jar, unleſs it meets with an equal quantity of *æther*, rendered *electric* by a phlogiſtic atmoſphere, on the *outſide* ſide of the jar; but if æther be preſent, by its attraction to *that æther* on the external ſurface, it becomes fixed to the *internal* ſurface, and may be accumulated till the jar be charged, and can take no more,

If now a communication be made, between the two oppoſite ſurfaces, the *two external atmoſpheres* of æther and phlogiſton, of the two ſurfaces, will firſt of all attract each other; in conſequence of which, the two *internal* atmoſpheres being drawn from their reſpective ſurfaces, will be brought into *contact alſo:* when, *loſing* their *electric* properties and arrangement, the *whole* will unite with violence; ſome *fire* or *light* being produced, by the new *mode* of *union* of the *two principles.*

That each ſtate of electricity, is compoſed of the two active principles, æther and phlogiſton, in one, the *æther* being excited to take an *atmoſphere* of *phlogiſton*, and in the other, *phlogiſton* being excited to take an *atmoſphere* of *æther*, on which different modes of arrangement, the different properties of negative, and poſitive electricity depend, is therefore ſufficiently evident, and further proved by the following facts.

If a *large* ball of metal, be *poſitively* electrified, and a *ſmall* cork ball be brought near it, the cork will be *attracted* and then *repelled;* but if the *poſitive electric atmoſphere,* be *one ſimple* fluid, why is the ball *repelled* after being attracted?—for, when iron is attracted by either phlogiſton, or æther, rendered magnetic, by *their ſimple* excitement round the poles of a needle, it is not again repelled: but the cork is repelled after being attracted: therefore, the *electric atmoſphere,* is *not ſimple, nor* compoſed of *one homogeneous* fluid. The reaſon of its *repulſion* after being attracted, is therefore this, the cork is attracted by the *external* atmoſphere of *æther,* by which it is drawn to the *internal* atmoſphere of *phlogiſton,* immediately ſurrounding the metal ball; *that internal* atmoſphere, is *communicable* from one ſubſtance, to another: but the *external* atmoſphere is *not,* unleſs the *internal* atmoſphere, *firſt ſeparates.* As ſoon therefore, as the cork comes into *contact* with this *internal phlogiſtic* atmoſphere, it becomes ſurrounded by it, and in conſequence of *that,* is again attracted by the æther, *which* gives it an *external* atmoſphere around it; and having then no longer an attraction for the ætherial atmoſphere in which it floats, by its levity it is puſhed to the *ſurface* of that ætherial atmoſphere, ſurrounding the heavier and greater body.

But, if the ball of metal be large, and ſtrongly excited, by being ſurrounded by a *great* quantity, or extent of electric atmoſphere, and the cork ball be *ſmall*, if it be *forcibly* puſhed into the *internal phlogiſtic* atmoſphere, and completely covered by it, it will remain there, firmly united to the ball of metal, and may be moved around it, without ſeparating from it; but if it be *raiſed out* of that *phlogiſtic* atmoſphere, part of which will adhere to it, ſo ſoon as it comes into contact with the ſurrounding *æther*, it will attract it, and be attracted by it; in conſequence of which, it will acquire an *ætherial* atmoſphere alſo, and be *puſhed* to the *ſurface;* ſo that its external atmoſphere, will only touch the utmoſt verge, of the external ætherial atmoſphere of the ball of metal.

Again, if a ball poſſitively electrified, be brought near another negatively ſo, their *external* atmo-

ſpheres

ſpheres will attract each other, at a conſiderable diſtance. If they be permitted to approach, conſiderably nearer than where they begin to attract, they ſtill may be drawn aſunder, and will be found to poſſeſs the ſame degree of electricity as before; but if they be ſuffered to approach *ſo near*, that the *two internal* atmoſpheres come *into contact*, they immediately ruſh violently into union with each other, and with their external atmoſpheres; and every appearance of electricity ſuddenly vaniſhes, with the peculiar arrangement of the principles, upon which it depended, and by which it was produced; and the two active fluids, the æther and phlogiſton, return to their *natural ſtate*; except *that part* of them, which by the violence of their union, took the form of *light* or *fire*, according to the force, and mode of combination, with which they united together.

Another experiment may be brought, to prove the ſame, which is, that if a conducting body, communicating with the earth, or not inſulated, be brought *within* the *electric atmoſphere* of any excited body, it will acquire an *electric* atmoſphere the *contrary* kind: and the nearer it approaches the excited body, the more will it become poſſeſſed of the oppoſite kind of electricity; 'till at length, being brought ſufficiently near to each other, the *two oppoſite* atmoſpheres will unite, and forming a luminous ſpark, their electric ſtates, and all the properties depending thereon, will be deſtroyed, and each body left equally devoid of electric excitement of either kind. Suppoſe the excited body be poſitively electrified, it will then have attracted to its ſurface, an atmoſphere of *phlogiſton*, ſurrounded by another of *æther:* this *external ætherial* atmoſphere, acting upon the conductor, ſurrounded by its *natural* quantity of æther and phlogiſton, in their *common* ſtate, will attract the phlogiſton; in conſequence of which, the *æther*, naturally combined with that phlogiſton, will *become excited*, and adhere to the *ſurface* of the *conductor*, like an atmoſphere; and at the ſame time, ſtill retain an attraction to *that phlogiſton*, which will now ſurround it like an atmoſphere. The two *external atmoſpheres*, continuing to attract each other, *cannot* unite *perfectly*, becauſe they are *each* ſtill retained, by the attraction of the *internal* atmoſpheres, adhering to the *oppoſite bodies:* the *nearer* the ætherial atmoſphere approaches the conductor, the *more* powerfully will it attract phlogiſton from it: and the *greater* muſt be the *quantity* of æther, diſplaced from its intimate natural union with *that phlogiſton,* and excited to attract the *ſurface* of the *conductor.*

The *external ætherial* atmoſphere therefore, of the electrified body, will keep attracting the phlogiſton of the conductor: and that phlogiſton will keep *depoſiting* its naturally combined *æther* on the *ſurface* of the *conductor,* where it will become *excited,* and attract *that phlogiſton* as an atmoſphere: till the two bodies approach *ſo near* to each other, that the *internal phlogiſtic* atmoſphere, of the *electrified* body, can touch the *internal atmoſphere* of *æther,* acquired by the *conductor;* when, they will *rapidly ruſh* into *union* with each other, and with their external atmoſpheres, mutually; in conſequence of which, *light* and *fire,* will be produced, with a *noiſe* and *ſhock*; and *every* appearance of *electricity* of *either* kind, in *either* body, will at the *ſame* inſtant *diſappear.*

The phenomena therefore of *electricity*, are produced by the *two active fluids*, *Æther* and *Phlogiſton:* when by *friction*, they become *excited* to attract the *ſurfaces* of *certain* bodies. Thoſe ſubſtances which have naturally a *greater* attraction to *æther*, than to phlogiſton, ſuch are for inſtance, amber and ſulphur, when rubbed, *attract* and *excite* that *æther*, which then takes an atmoſpheric form upon that ſurface; and the phlogiſton naturally combined with it, by this ſeparation and friction, becomes equally excited, on the ſurface of the rubber; and the globe, and rubber, by means of thoſe atmoſpheres, attract each other.

But, when the two excited ſurfaces *part*, the *æther* will not *quit* the ſurface of the globe of ſulphur: neither will the phlogiſton quit the rubber: but the æther not being capable of entering into a cloſe, or chemical union with the ſulphur, although ſtrongly excited to it, and in a ſtate of great activity, ſeizes *that phlogiſton*, which in the common, or natural ſtate, is ſupplied by the rubber: and the globe becomes *electric;* having an atmoſphere of *æther* attracted to its *ſurface*, and that æther being

ing ſurrounded by an *external* atmoſphere of *phlogiſton.* But, at the ſame time that the ſtrongly excited *ætherial* atmoſphere of the *globe,* when it parts from the rubber, ſeizes the neighbouring *phlogiſton;* the equally excited *phlogiſton* on the *ſurface* of the *rubber,* ſeizes the *æther ſeparated* from *that* phlogiſton; with which it invelopes itſelf like an atmoſphere, as it flows over the edge of the rubber.

The oppoſite takes place with reſpect to the globe and rubber, when glaſs is employed.

Glaſs from its chemical nature and compoſition, hath a greater attraction for phlogiſton, than to æther; when excited therefore by friction, it will attract the excited *phlogiſton* to its *ſurface;* which not being capable of chemically combining with the glaſs, although ſtrongly excited, will ſeize upon *æther* ſufficient to ſurround it. And the other oppoſite principles, diſengaged in theſe caſes, will become equally excited to the rubber; the æther by means of the exciting glaſs, deprived of its phlogiſton, will ſtrongly attract the rubber, and that excited æther, when forced to ſeparate from the phlogiſton, excited by, and attracted to the globe, will aſſume an *external* atmoſphere, compoſed of the *phlogiſton*, ſeparated from the æther forming the external atmoſphere of the glaſs.

It appears therefore, that as the *magnetic* poles, reſemble the earthy and acidifying principles, as being *ſolid centres* of matter, ſurrounded by atmoſpheres of *æther* or *phlogiſton*: each mutually attracting the other; ſo, two balls poſitively and negatively electrified, will greatly reſemble the *ſame two fixed principles*, when in the ſtates of *evident alkalinity* or *acidity*. For the *earthy* principle never manifeſts its *alkaline* properties, but when ſurrounded by more or leſs *phlogiſton*; neither does the *acidifying* principle appear evidently *acid*, but when it is ſurrounded with ſome *æther*; if that atmoſphere of æther be *ſmall*, it will be ſo much the *more excited*, and that excitement produces the ſenſation and phenomena of *acidity*; but if it be very *great*, or widely extended, it will be ſo *gently* excited, as to ſhew *no evident acidity*, as when in the ſtate of pure air.

A particle of the earthy principle is a particle of *fixed* matter, actuated by being united to, and ſurrounded by the *ætherial* principle; and when that is ſurrounded by an *external atmoſphere* of *phlogiſton*, it becomes evidently *alkaline:* but if ſurrounded by ſo large a quantity of phlogiſton as to become in an aeriform ſtate, its alkaline properties are not ſenſibly evident, as in inflammable air; in which ſtate, it reſembles a *body electrified* by means of *ſulphur*, or of any phlogiſtic electric; as being a ſolid body, having an *internal* atmoſphere of *æther*, ſurrounded by an external atmoſphere of *phlogiſton*.

In like manner, a particle of the acidifying principle, is a *fixed* particle of matter, actuated by *phlogiſton*, which phlogiſton by being ſurrounded by an *external* atmoſphere of *æther*, forms a particle evidently acid: in which ſtate, this acidifying particle is ſimilar to a particle of matter, *electrified* by excited *glaſs;* the ſolid centre attracting phlogiſton, and that phlogiſton taking around it an atmoſphere of æther.

The chief difference between the two ſolid principles, when in that ſtate in which they are aeriform or ſurrounded with complete external atmoſpheres, and two bodies ſurrounded by the two oppoſite ſtates of electricity, is, that the acidifying and earthy particles, can only be deprived of their *external* atmoſpheres by uniting, becauſe their internal atmoſpheres being immediately united to their reſpective fixed particles, can never more be ſeparated, as being excited by thoſe fixed particles, to attract with the *greateſt force* they are capable of exerting.

But, any body will part with *both* its internal and external *electric* atmoſpheres, when thoſe atmoſpheres can meet with atmoſpheres of the contrary fluids, in a ſimilar ſtate of excitement: in which caſe, each fluid meeting with its oppoſite, to which it hath a ſtrong attraction, will unite, and by that union, the *arrangement* of *both* kinds will be deſtroyed, and with it every appearance of *electricity*, as being a property ariſing from that arrangement; therefore, theſe excited atmoſpheres of the two different kinds, mutually ſatisfying each other, will deſtroy the attraction by which they were held to their reſpective ſurfaces; becauſe they were not *chemically*, or *intimately* united to thoſe ſurfaces, but only *ſlightly* and *ſimply* attracted by being in *contact*.

Æther or phlogiſton have therefore, only a ſlight attraction to the ſurfaces of electric ſubſtances: and when excited by friction, neither of them can ſufficiently attract the electric ſurface ſo as to fix itſelf, or acquire the electric ſtate, unleſs it can meet with the *oppoſite principle* to *attract around it*; by which, and the attraction of the electric *ſurface* together, its excited attraction will be ſufficiently ſatisfied, ſo as to enable it to aſſume, and preſerve *that atmoſpheric* form, upon which its *electric* properties depend.

The *electric* ſtates of æther and phlogiſton, are therefore very different from thoſe ſtates, in which, by the powerful attraction between them and iron, they aſſume the *magnetic* arrangement. For by iron, they are ſo equally and powerfully attracted and excited, that *either* of them is capable of forming an atmoſphere around it, which by its powerful excitement, will ſtrongly attract the oppoſite principle, and with it the excited pole, or iron, which it ſurrounds and attracts; and when the two oppoſite poles, or one of thoſe poles and iron are in contact, they will remain ſtrongly united.

But, when a body is attracted by an *electric* atmoſphere, it is drawn towards the excited body, till it touches the *internal* atmoſphere, by which it becomes ſurrounded, and by that means acquires an attraction to a *part* of the external atmoſphere alſo: which having acquired, it becomes equally electrified, as the excited body, and is no longer attracted, but recedes to the ſurface of the external atmoſphere of the firſt body.

They differ in this too, that two fluids forming one kind of electric atmoſpheres, have a *greater* attraction to the *two oppoſite fluids*, in a ſimilar but contrary atmoſpheric ſtate of arrangement, than they have for the *ſurfaces* to which they are attracted; in conſequence of which, they *will* leave thoſe ſurfaces to unite with each other. But when in the magnetic ſtate of excitement round iron, they have a *greater* affinity to *that iron*, than to each other; in conſequence of which, they *will not* quit the iron, to unite, ſo as to deſtroy their magnetic excitement.

But they reſemble each other in this reſpect, that when *one* fluid is peculiarly excited to *magnetic* arrangement, around one pole of a needle, the *other* fluid aſſumes a ſimilar ſtate around the contrary pole: in the ſame manner, as when *one* of them is peculiarly excited to take the *electric* ſtate around the globe, the *other* becomes equally excited and attracted by the rubber.

All bodies are naturally ſurrounded by æther and phlogiſton in their common ſtate of combination, in which ſtate either of them is capable of being attracted by its oppoſite, in the electric ſtate of excitement; conſequently, an electrified body, will attract another body of any kind; which ſhews, that the *degree* of *excitement* in the *common* ſtate, is not *much different* from that in the *electric* ſtate; and that the *chief difference* is, that in the common ſtate, the *two fluids* are *uniformly mixed*, but, in the *electric* ſtate, they are *ſeparated* ſo as to become *atmoſpheric*, *each* to *the other*. For neither the æther nor phlogiſton naturally combined, and attracting all bodies, will ſeparate, or enter into new combinations, unleſs *the other* can aſſume a ſimilar ſtate of excitement. But the *phlogiſton* ſurrounding *any other body* than iron, will not have any attraction to the *ætherial magnetic* atmoſphere of a needle, becauſe the *magnetic* attraction of arrangement, is *too great* to be affected by the weaker attraction of *union*, of the oppoſite fluid in the *common* ſtate; but if it *could* be attracted by the magnetic ætherial atmoſphere, the *æther* with which it is combined, would not be ſo ſtrongly attracted by *that body*, as to enable it to take the ſimple form and force of attraction, neceſſary, to give it a *magnetic* arrangement; for if the body did not attract the *æther* ſurrounding it, ſo forcibly as the ætherial magnetic atmoſphere did the *phlogiſton*, they would not ſeparate and form magnetic atmoſpheres; therefore, which ever were attracted, the other would go along it: conſequently, no ſubſtance but *iron*, in an unexcited ſtate, attracts the naturally ſurrounding æther and phlogiſton, with ſo much force as to enable them to be attracted and drawn towards the magnet, by means of their attraction to it: and therefore, no ſubſtance but iron can attract an atmoſphere of either æther or phlogiſton, with ſuch force as to render it magnetic.

That no ſubſtance but iron can become magnetic, or be attracted by a magnet, is therefore evident from this, that when either phlogiſton or æther is excited, every particle hath its attraction of arrangement to ſimilar particles, and its attraction of combination to the particles of the other kind, in a degree proportionate to that excitement: if therefore two particles of *æther* be excited, ſo as to attract each other, with the force of 1, each contiguous particle muſt have nearly the ſame force; therefore, their *mutual* attraction of arrangement, will be with the force of 2, and their attraction of combination to phlogiſton will be in the ſame proportion; but if two particles of *phlogiſton* be *each* excited to attract the other, with the force of 2, they will unite together with the force of 4, and their attraction to æther will bear the ſame proportion.

A particle of this phlogiſton therefore, whoſe excitement is equal to 2, being brought into contact with *one* of *thoſe* particles of *æther*, whoſe excitement was as 1, they will attract each other into *union* with the force of 3; but two of thoſe particles of *phlogiſton* attract each other to *arrangement*, with the force of 4: conſequently, thoſe phlogiſtic particles will not ſeparate from their arrangement, to combine with the æther; becauſe, the *mutual* attraction of *arrangement*, in that ſtate of *great excitement*, is *more powerful*, than the *attraction* of *combination* with the *æther*, *ſlightly excited.*

The particles of æther or phlogiſton therefore, when they form magnetic atmoſpheres around iron, are *ſtrongly* excited, and *ſtrongly* attract each other to arrangement: but when they form electric atmoſpheres, around bodies, they are but *gently* excited, and *weakly* attract each other; and conſequently, their attraction of combination, with the oppoſite kind of particles, muſt be proportionately weak; 'tis evident therefore, that they will attract the oppoſite kind of particles, ſtrongly excited by the magnetic arrangement, with *leſs force* than *thoſe particles* attract each other; conſequently, the *magnetic* particles will ſuffer *no derangement*, and the magnetic and electric atmoſpheres, though formed of the two different principles, being ſo *differently excited*, and attracting with ſuch *different degrees* of *force*, will never *derange*, or *unite* with *each other*.

An ætherial magnetic atmoſphere will therefore, not be ſenſibly attracted by a phlogiſtic electric atmoſphere in a much leſs excited ſtate, becauſe the magnetic attraction of arrangement between the particles of æther, is much greater *than*, and will not give place *to* the weaker attraction of union, exerted by the ſlightly excited electric atmoſphere of phlogiſton; therefore there can be no approximation of their reſpective centres: becauſe not being equally excited and active, they cannot deſtroy each others arrangement, and form lines of attracting particles, drawing one centre to the other.

For the ſame reaſon, *that* combination of æther and phlogiſton, ſurrounding all bodies, and producing *univerſal attraction*, or *gravitation*, being a ſtill *gentler* degree of excitement, cannot derange or be deranged by thoſe fluids, when in different ſtates of excitement they acquire different degrees of attraction, and conſtitute electric or magnetic atmoſpheres: becauſe, the gentle attraction of that arrangement, producing univerſal attraction, can *never deſtroy* the *ſtronger* force with which *thoſe* particles attract each other, when they are excited to take the *other modes* of arrangement.

But whether *theſe active principles* are *ſo excited*, as to produce the attraction of gravity, electricity, or magnetiſm, they always in the *ſame ſtate*, have the *ſame* degree of excitement; ſo that in any one of theſe three general ſtates of attraction, they always have a power of acting upon each other; but *not* in any *two different* ſtates; and the difference of force with which they attract in the ſame ſtate of excitement, is always produced by the difference of the *quantity*, or *number of particles* excited.

The other two ſtates of excitement, reſemble that producing general attraction in this reſpect, that when an atmoſphere of either the electric or magnetic excitement, approaches an atmoſphere of the other active principle, in a ſimilar ſtate of excitement, they attract and deſtroy each others *peculiar atmoſpheric arrangement*, and form lines of the two different kinds of particles, parallel, contiguous, and progreſſively uniting to each other; and conſequently, attracting and drawing into *contact*, the bodies to which they extend; exactly in the ſame manner, as when in that ſtate producing univerſal gravitation or attraction.

Having now taken a view of the two active principles, in their different ſtates of excitement, when combined with, or attracted to fixed particles of matter, or bodies containing and compoſed with ſolid matter: I ſhall next examine *them*, in their ſtates of *combination*, *unconnected* with *ſolid bodies*; or not depending upon any union with, or excitement *from them*; which will be the ſubject of the two following Sections.

SECTION XI.

On Fire.

FIRE is that ſubtile fluid, which is capable of penetrating and expanding all bodies; and is known likewiſe by the ſenſation of *heat* which it produces, by its action upon the body.

A body therefore is heated, or hot, in proportion to the quantity of this fluid contained in its interſtices, or flowing from its ſurface, to reſtore its equilibrium, by paſſing into bodies or ſpaces, containing a leſs quantity, than the heated body.

That fire is a ſubtile fluid actually exiſting, and by its action or motion, produces heat, or that ſtate of bodies which we call heated, is too evident to need inſiſting upon; for if it were not, an active fluid, like all other fluids endeavouring to reſtore or keep itſelf in an equilibrium, how is it poſſible that a heated body, ſuſpended in vacuo, ſhould communicate a part of its heat, to a colder body at a conſiderable diſtance from it? if heat were no other than a violent *motion* of the particles of which bodies are compoſed, the ſuſpended heated body, could not communicate motion, or heat to another body not in contact, when there is nothing but a *void* between them; or if it could, it muſt be by means of the ſubſtance by which it is ſuſpended: and in that caſe, the *upper* part of the exhauſted receiver to which the ſuſpending ſubſtance is faſtened, would be *hot*, *ſooner* than that part of the receiver oppoſite to the heated body; but it is not ſo, the heated body communicates its heat to any other near body, not in contact, through a *vacuum*: therefore, the heated body communicates *ſomething* flowing from its ſurface, to the colder body; *that ſomething* by its action produces the ſenſation which we call *heat*, or communicates to bodies, thoſe properties by which we know them to be *heated*; and *that ſomething* is *fire*, whoſe exiſtence is known by its action and effects; its action we call *heat*; and its affects are thoſe which muſt ariſe, when the component principles of bodies are *ſeparated* by the *interpoſition* of *fire*; conſequently, its effects upon different ſubſtances muſt be different: and the *greater* the proportion of the two active principles, entering into the compoſition of bodies, the *more evident* will be thoſe effects.

A metal conſiſts of particles of the earthy principle, attracted to each other by a ſmall proportion of phlogiſton, interpoſed between thoſe earthy particles. If a number of *igneous* particles inſinuate themſelves between *thoſe* particles, they will cauſe them to recede a little from each other, and the conſolidating or attractive power of the connecting *phlogiſton* will be *weakened*, as *that diſtance* between the earthy particles *increaſes*. If the quantity of intervening fire be conſiderable, the attractive power of the phlogiſton will be ſo weakened, that the earthy particles will be capable of being *eaſily moved* among each other, ſo as to be in a ſtate of *fluidity;* and if the quantity of *heat* be *ſtill augmented*, by inſinuating itſelf between every line of active particles, ſurrounding the fixed central particles of matter, and between every particle forming thoſe lines, they will be *ſo far removed* from their centres, and their *attraction* to them ſo *weakened*, that *both* the *ætherial atmoſpheres* immediately ſurrounding the fixed particles, forming the earthy principle, and the connecting *phlogiſton*, will be ſo far dilated, by the fire interpoſed between every particle, that they will *recede* to *ſo great* a *diſtance*, as to become volatilized, and eſcape in the form of vapour. But ſo ſoon as the igneous particles ſeparating and diſtending them, are removed, by paſſing off into ſurrounding bodies, *leſs heated:* thoſe *expanded atmoſpheres* will gradually *contract*, and become *fluid*, or *ſolid* in progreſſion, as the particles of fire eſcape from the interſtices, betwixt the atmoſpheric lines which thoſe active fluids form around thoſe fixed particles.

Fire therefore is a fluid, or compoſed of ſubtile particles, and its *action* partly *mechanical*, weakening the attraction between the component principles of bodies, by inſinuating itſelf into the interſtices, formed by the arrangement of thoſe principles, around their fixed centres; and even between each particle, and increaſing their diſtances from each other; by which, their attractive powers are proportionately diminiſhed.

The particles of fire ſeem to have but *little attraction* to *each other*, but a *general attraction* to the *atmoſpheres* of *other bodies*, of whatſoever kind: they ſeem to poſſeſs a *fluidity*, or tendency to *equal diffuſion*, like water; and conſequently, cannot form any atmoſpheric arrangement around other bodies: from all of which, when accumulated in, or upon them, it ſeems to flow of, according to the laws of fluidity, ſeeking to reſtore itſelf to an equilibrium.

It evidently differs therefore, from æther and phlogiſton in their ſimple ſtates, or in their ſtates of excitement around bodies producing the phenomena of coheſion, electricity, or magnetiſm: it can therefore be *neither one nor* the *other* of them, *ſingly*; but, there can be no doubt that it is *compoſed* of *the two*; as is evident, both from ſyntheſis and analyſis.

The *electric fluids* are phlogiſton and æther, in *certain* ſtates of excitement; which, when they unite, form *fire*; as is evident from their melting metals, firing gunpowder, &c.

Inflammable ſubſtances when ignited in pure air, produce *fire*; at the ſame time that they loſe their *phlogiſton*, and the pure air its *æther*; therefore, the *phlogiſton* and *æther* uniting, form *fire*.

Certain *calces*, compoſed of earth and acid, when ſeparated by the interpoſition of *fire*, ſo far from each other, as to be no longer attractive, or attracted, are capable of *decompoſing* that *fire itſelf*;

the

the earth will attract its *phlogiſton* and acquire its metallic ſtate; and the acid will combine with its *æther* and form pure air.

Fire therefore, is evidently a compoſition of *æther* and *phlogiſton*, combined to ſaturation, or nearly ſo; in conſequence of which, each fluid loſes its general properties of attraction to certain kinds of matter, and of atmoſpheric arrangement in conſequence of that attraction to bodies; and the degree of their attraction and activity, is equal to the degree of their excitement, when they combine with each other; therefore, when æther and phlogiſton are *ſeparated* from their reſpective baſes, by means of heat, and in that ſtate combine, they will ſtill retain that degree of activity, and form *fire*.

But the degree of excitement of each, will in a great meaſure depend upon the force with which it was combined with its reſpective baſe: excitement being always proportionate to attraction; but the *phlogiſton* united to certain bodies, ſo as to render them inflammable, is in general, ſo strongly ly excited, as to attract thoſe particles together in a *ſolid form*, while the æther ſurrounding the acidifying particles in the form of pure air, is but *looſely combined*, and conſequently moderately excited; therefore, 'tis natural to ſuppoſe, that when *that phlogiſton* combines with this æther, it will be *more excited* than the æther is; but, being *forced* to ſeparate from its earthy baſe, by the acid of the pure air attracting it, it muſt of neceſſity *unite* with the *æther*, and that union will produce *fire*, a compound of *æther* and *phlogiſton;* in which ſtate of union, however, the *phlogiſton appears to be moſt excited*, and conſequently moſt active.

In conſequence of this *greater* excitement of the *phlogiſton*, it will manifeſt its ſuperior power, and have a *greater* degree of attraction to thoſe ſubſtances which contain *æther*, either *ſimple* or *compound*, *than* to *thoſe* chiefly compoſed with *phlogiſton;* with ſuch kind of ſubſtances therefore, it will form a *ſlight* union, ſo as to be *detained* in their interſtices, in a combined or *quieſcent* ſtate; but with ſubſtances containing phlogiſton, or more phlogiſton than æther, it *cannot combine*, and will therefore flow through them *ſimply* as a *fluid.*

Pure air therefore, being compoſed chiefly of *æther*, widely extended in an atmoſpheric ſtate around its centres of the acidifying principle, will *ſtrongly attract fire*, on account of the *ſuperior activity* of its *phlogiſton*, which it will retain in a *quieſcent ſtate*, in its interſtices, or between its particles; but *inflammable air*, will *not* attract and retain it; becauſe, its aeriform ſtate depends upon atmoſpheres of phlogiſton ſurrounding the earthy particles as centres; therefore, the *quantity* of *fire* attracted by a certain meaſure of *pure air*, will *greatly exceed* the *quantity* flowing through an equal meaſure of *inflammable air.*

In like manner, a *metal* containing phlogiſton, will not attract the fire flowing through its interſtices, ſo as to fix or accumulate it: but if that metal, by calcination, be deprived of its phlogiſton, and in its place attracts the acidifying principle, the *calx* formed by that combination, will attract the phlogiſton, and conſequently fix a ſmall quantity of the *fire*, which it in part compoſes; becauſe, the acidifying principle in its acid ſtate, hath an atmoſphere of æther of ſmall extent, and therefore the more active.

The ſuperior activity of *phlogiſton*, when combined with æther ſo as to form fire, appears highly probable, and readily accounts for the *different capacities* of different kinds of ſubſtances, for containing *heat*; a ſolid or fluid, containing *much æther*, will *attract* and *fix* a certain proportion of *fire:* but a body containing much *phlogiſton*, will *not* attract or retain it: therefore, it flows from it on one ſide as faſt as it is thrown in on the other; if any ſolid or fluid containing a leſs quantity, be near to receive it.

Pure air, on account of the *æther* in a great meaſure compoſing it, contains, or attracts and *detains* a conſiderable quantity of fire. If a piece of *phoſphorus*, containing much *phlogiſton*, be put into a certain meaſure of it, the phlogiſton of the phoſphorus will attract and combine with that *æther*,

ther, and eſcape in the form of light and *fire*: by which combination, its *acid* baſe will be depoſited, and the *ſmall quantity* of *fire*, combined with its ætherial atmoſpheres, now in a great meaſure loſt, will be *diſengaged* and become *ſenſible alſo*; excepting that ſmall part of it, attracted and detained by the acid.

The *leſs* the quantity of fire contained in a certain meaſure of pure air, the *greater* the quantity of heat it will produce by combuſtion with inflammable ſubſtances; becauſe, the *æther* will be *leſs rarified* or expanded; and conſequently, a certain meaſure of pure air, will contain a greater quantity of *it*, capable of combining with a *greater* quantity of *phlogiſton*, and producing *more fire*, *than* when rarified by a greater quantity of heat.

Fire is never *chemically* produced, but when æther and phlogiſton have an opportunity of *combining* together, and *ſeparating* from their reſpective ſubſtances; therefore, an inflammable ſubſtance, ignited in pure air, can only produce *fire* by *decompoſing each other;* when the *phlogiſton* of the ſubſtance, combines with the *æther* of the air, and forms *light* or *fire*: and the *acid* of the air, unites with the *earth* of the inflammable body; and that this is in reality the caſe, not only the *diſappearance* of the phlogiſton of the inflammable body, and the æther of the air, when fire is produced, proves, but likewiſe, the *decompoſition* of *fire itſelf* by certain metallic calces, where it evidently affords *phlogiſton* to the *earth* of the metal, and *revives* it: and at the ſame time, ſupplies the *acid* with *æther*, and converts it into *pure air*.

Fire is therefore evidently compoſed of æther and phlogiſton, combined with each other in a ſtate of great excitement; in which ſtate they were ſeparated from the ſubſtances with which they were previouſly combined; but it ſeems, that the *phlogiſton* entering into the compoſition of fire, is *rather more excited* and *active* than the æther is. Perhaps the nature and properties of fire, depend upon the phlogiſton being more excited than the æther with which it is compoſed: and when æther and phlogiſton combine, each being *equally excited*, they ſo perfectly counteract each other, as to produce *no* ſenſible effects; but, when the *æther* is *more excited*, than the phlogiſton, they then by uniting, form light.

However, fire is evidently a fluid, compoſed of æther and phlogiſton, intimately united: where the phlogiſton appears to be moſt active, or moſt abundant: but yet, they are ſo cloſely combined, and mutually ſaturated, that they deſtroy each others elaſticity, or arrangement, and become a compound fluid, poſſeſſed of properties peculiar to itſelf; and thoſe principles are never decompoſed, or ſeparated from each other, ſo as to form *chemical* combinations with earth, or acids, but when the quantity of fire is ſo great, and violent, as to *deſtroy* the power of union, between the *earthy* and *acidifying* particles compoſing a body; in which caſe, thoſe particles will ſeize upon the fire itſelf: the *earth* will exert its power of attraction upon the *phlogiſton*, and the *acid* upon the *æther*, and form two new compounds.

Fire then is an active fluid, whoſe properties as a compound of the two active principles, are very ſimilar to thoſe of *water*, a compound of the two fixed principles. Water hath a very general attraction to bodies: ſo hath fire. Water hath ſo ſtrong an affinity with many kinds of ſolid or more fixed ſubſtances, as to overpower their attraction of coheſion, and remove their component particles at a diſtance from each other, by inſinuating itſelf between thoſe particles; but when the water is evaporated, the particles are left unaltered in their natures or properties. Juſt ſo it is with *fire*, with reſpect to the *atmoſpheres* of *active fluids*, eſſential to the principles of which bodies are compoſed, or connecting thoſe principles together; for fire hath a general attraction to active particles of *either kind*, and when *either of thoſe* are arranged around fixed principles in either a ſimple or compound ſtate, ſo as to form acids, earths, alkalis, neutral compounds, metals, or any other kind of ſubſtances: thoſe eſſential or connecting atmoſpheres of whichſoever kind, are attracted by this active compound; and if it be preſent in ſufficient quantity, thoſe atmoſpheres are as it were diſſolved by it, becauſe it inſinuates its particles into *every interſtice*, and even *between every particle* compoſing them; in conſequence of which, they become more extended, the bulk of the body is increaſed, the attraction of thoſe atmoſpheres to their fixed centres, are proportionately weakened, and indeed according to the quantity of fire inſinuating itſelf between the particles forming thoſe atmoſpheres, ſolid bodies may be rendered fluid, and fluids expanded into vapour; but ſo ſoon as the particles thus ſeparated by the diſſolving or interpoſing fire, are deprived of that fire, by ſuffering it to eſcape, they return to the ſtate, and acquire the properties they poſſeſſed, before they were heated.

Indeed, Water and Fire ſeem to be the two grand ſolvents, and chief agents in nature; *water* being chiefly compoſed of the *two fixed principles*, hath its attraction, or exerts its diſſolving powers chiefly upon them; while *fire*, being a compound of the *two active principles*, ſhews its attractive power upon thoſe active particles, by inſinuating itſelf between them, ſo as to weaken their connection and increaſe their extent.

Both water and fire enter into the compoſition of moſt bodies, in a greater or leſs degree, or quantity; in which ſtate, their peculiar properties do not appear; but if thoſe bodies be decompoſed, or their particles approximated, the water, or fire, or both may become evident.

Though fire hath a kind of diſſolving power, upon atmoſpheres of either kind of active particles, the ſame as water hath with reſpect to acids and alkalis, yet it ſeems to be moſt attracted by *æther*, or *ætherial* compounds, which have an affinity with it, and a power of combining with a certain proportion of it, ſo as to keep it in a *latent ſtate*, or in fact, combined with thoſe ætherial atmoſpheres: ſo acids, or compounds containing much acid, have a ſtrong affinity with water, which they take into their compoſition, in a *latent* ſtate; and which by decompoſition, or concentration by heat, may be rendered evident; in the ſame manner, as fire may become ſenſible by condenſing or altering the ſtate of a body detaining it, to a more ſolid form.

Water may be *decompoſed* by certain bodies, as for inſtance by iron: the earth of the iron attracting its acidifying particles, and forming a *calx*, or *ſlag*, while the earthy principle of the water, combines with the diſengaged phlogiſton of the iron, and becomes *inflammable air*; in like manner, *fire* may be *decompoſed* by the calx of mercury for inſtance, the earth of the calx attracting its phlogiſton, and becoming mercury, and the acid diſengaged from that earth, combining with its æther, and forming pure air. And an *earth* and *acid* in *certain ſtates*, combining together, as invariably produce *water:* as *æther* and *phlogiſton*, when ſufficiently excited, by *uniting* form *fire*.

Fire therefore, is evidently compoſed of *æther* and *phlogiſton*, in a ſtate of *ſtrong excitement*; and is a *compound fluid*, having a *general attraction* to thoſe principles in an atmoſpheric ſtate: and a peculiar attraction to *ætherial* compounds, with which it can ſo far enter into combination, as to *loſe* its *active properties*, and become *latent*, or *inactive.*

PATENT OFFICE LIBRARY

SECTION XII.

On Light.

LIGHT is an elaſtic fluid, whoſe general properties of refraction, reflection, &c. are well known to all philoſophers.

It is evidently of different kinds, or compoſed of particles ſimilar to each other in ſubtilty, elaſticity,

ticity, velocity, &c. but when ſeparate producing different ſenſations, or ideas of colour different from each other; and the different kinds compoſing a beam of ſolar light are ſeven, (or perhaps but three;) which, when ſeparated, and in that ſingle or uncombined ſtate, falling upon the reticular expanſion of the optic nerve, produce the ſeven different perceptions or ideas, which are called the ſeven primary colours.

Light is evidently compoſed of *æther* and *phlogiſton*, becauſe, it is almoſt always produced when inflammable ſubſtances loſe their *phlogiſton*, by combuſtion in pure air, which by that ſame proceſs, loſes its elaſtic principle, its *æther*; therefore, the phlogiſton and æther uniting, eſcape in the form of fire, accompanied with *light*.

And the ſame is fully proved, by metallic calces acquiring *phlogiſton*, by being expoſed to the *ſolar light*; and at the ſame time, the diſengaged *æther* of the light, forming *pure air* by uniting with the *acidifying* principle, diſplaced from the calx by its acquiſition of phlogiſton, and becoming a metal. And indeed, ſo many circumſtances tend to prove it, and ſo much hath already been ſaid upon the ſubject, in different parts of this work, that I ſhall only mention this one additional circumſtance.

Vegetables by expoſure to *light*, evidently *decompoſe* it, and retain and fix its *phlogiſton*, at the ſame time, that the *æther* the other part of light, is thrown off as uſeleſs or excrementitious; it therefore combines with the acid particles in the fluids of the vegetable, and is expelled in the form of *pure air*.

Light is very different from either æther, or phlogiſton ſingly; becauſe, being compoſed of *both*, their peculiar attractions, and arrangements, counteract each other; and it will therefore neither form atmoſpheres around bodies, nor enter into chemical union, *unleſs* it be *decompoſed*.

It differs from fire, though compoſed of the ſame principles, as being much more elaſtic, and ſubject to refraction and reflection, according to circumſtances.

However, fire when rapidly flowing off from the ſurface of any body, in which it is greatly accumulated, is *partly* changed into *light*; and light when thrown in a *condenſed* ſtate, upon a body which reſiſts its motion, and refuſes it a ready paſſage through its pores, becomes *partly* changed into *fire*.

Fire and light therefore, are evidently compoſed of the ſame principles, æther and phlogiſton; but having different properties, thoſe principles muſt be in different ſtates of combination; in *one ſtate* exciting the ſenſation of heat, and poſſeſſing thoſe properties which we attribute to *fire:* and in *the other*, producing the ſenſation of colours, lights and ſhades, and all the phenomena of *light*.

Though æther and phlogiſton, when in that ſtate of combination which we call light, deſtroy each others peculiar affinities to other bodies, and arrangement, ſo as to form a fluid almoſt any chemical affinities, yet it appears, that the *æther* is the *moſt excited* and *active* of the two; becauſe light will paſs readily through bodies chiefly compoſed of æther or acid: but to bodies containing much earth or phlogiſton, it ſeems to have ſo great an affinity, that it will not eaſily leave them; and therefore, in paſſing through them, it *loſes* ſo much of its force and elaſticity, as to be *incapable* of exciting the perceptions or ideas of light, and in general is charged into *fire*, and gives the ſenſation of *heat;* for moſt *earthy* bodies, and *inflammable* ſubſtances, are *opaque* and become *heated* by expoſure to light.

It appears therefore, when æther and phlogiſton combine and form *fire*, that the *phlogiſton* is *moſt* excited; but when they form *light*, the *æther* is the *moſt active;* and when by any circumſtance, they ſuffer a conſiderable change in their mode of combination, they may be *converted* from *one ſtate* to the *other*; and when expoſed to each others action, in the two different ſtates, they may counteract and deſtroy each other, as we evidently ſee is the caſe, when the light of the ſun falls upon a fire, the ſuperior activity of the *æther* in the light, counteracts the greater excitement of the *phlogiſton* of the fire, by which they deſtroy each other: the fire becomes dull, and is at length extinguiſhed.

But ſince light is compoſed of æther and phlogiſton, how does it happen, that different particles of it, are poſſeſſed of different properties, and produce different ſenſations or ideas of colour? It muſt be owing to *different particles* of the *æther*, having *different degrees* of *excitement:* or, to the different proportions of phlogiſton combined with that æther.

If *glaſs* contains *no* phlogiſton, but as I have before mentioned, be chiefly compoſed of acidifying particles firmly united by a ſmall proportion of æther, or with a ſmall quantity of earth, it will follow, that the *violet rays* of *light*, being *more refracted* by the priſm, than the *red*, muſt contain *more phlogiſton*, or *æther leſs active*, than the red rays do; as being more impeded, or drawn aſide, in their paſſage through the phlogiſtic atmoſphere attracted to the ſurface of the priſm.

For if glaſs be chiefly compoſed of acid and æther, it will naturally attract the circumambient *phlogiſton*, like an *atmoſphere*, to its ſurface; and this phlogiſton will attract the active *æther* of *light*; but, as they cannot combine, the *motion* of the particles of light will carry them forwards; which accounts for the transparency of glaſs, which tranſmits light without reflecting it.

But, inflammable ſubſtances, *gold* for inſtance, being compoſed of earth and phlogiſton, will naturally attract to its ſurface the ſurrounding *æther*, every where preſent, and *that æther* will *repel every particle* of *light*, whoſe æther is in a ſtate of excitement *ſimilar* to itſelf; gold therefore attracts to its ſurface an atmoſphere of *æther*, which is *excited* by that attraction to a *certain degree*: if a beam of light falls upon this, the *æther* of the *yellow rays*, being *juſt as much excited* more than its phlogiſton, as the *æther* ſurrounding the *gold* is, will be *repelled* or *reflected*, and give the perception or idea of a *yellow colour*, in different degrees of light and ſhade, according to the form of the ſurface expoſed.

But *thoſe rays*, whoſe æther is either *more*, or *leſs excited*, than the æther attracted to the ſurface of the gold, will only be *partly* and *weakly* reflected; part of them having perhaps even a ſlight attraction of arrangement, to that more or leſs excited ætherial atmoſphere of the gold, will therefore *paſs* through it, to the gold itſelf; where, being attracted by its phlogiſton, they will loſe their velocity, and the *peculiar excitement* of their *æther*, upon which the properties of light depend; and *that æther*, will then combine with the *phlogiſton* accompanying it, now *equally* active, as itſelf, or perhaps *more ſo*; and by that new mode of combination, they will form *fire*.

'Tis evident therefore, that no particles of light will be repelled, or reflected with their full force, or velocity, but *thoſe* whoſe *æther* is in a *ſimilar* ſtate of excitement, and equally attracted by *their* *own phlogiſton*, as the *ætherial* atmoſphere of the *metal* is, with reſpect to the *phlogiſton* entering into the *compoſition* of that *metal;* in which caſe they cannot unite, or penetrate each other; therefore, thoſe particles of light will be *repelled* by their velocity and elaſticity, while the other particles will be *ſlightly reflected*, or partly retained, and being promiſcuouſly and violently mixed together, will loſe their elaſticity and form *fire*, and give the ſenſation of heat inſtead of light.

Since then the violet rays are the moſt, and the red the leaſt refracted by glaſs, it appears, that the violet rays, or particles of light, contain æther in the leaſt active ſtate, and the red rays have their æther in the moſt excited ſtate; conſequently, as excitement is inverſely proportionate to the quantity, or extent of atmoſphere, it muſt follow, that particles of light giving the idea or perception of a *violet colour*, are compoſed of *phlogiſton*, with a *large atmoſphere* of æther: and *red rays*, of phlogiſton, with a *ſmall* and *more excited* atmoſphere of *æther;* and the intermediate rays of the ſpectrum, have their æther more or leſs excited, or extenſive, as they approach, or recede from thoſe extremities of the ſpectrum, of ſeparated light.

Lead in its native ſtate, contains much phlogiſton; that quantity of phlogiſton being conſiderable, and *looſely* united to the earthy baſe of the lead, will be but *ſlightly* excited; and in conſequence of that, will attract an atmoſphere of *æther* to its ſurface, which will be ſlightly excited alſo; when therefore, rays of light fall upon the lead, the æther of the blue rays being but ſlightly excited, and in a ſimilar ſtate with the æther ſurrounding the lead, will be *forcibly reflected*; but the other rays, green, yellow, orange and red, having æther in a *more* excited ſtate, and more attractive to phlogiſton, will only be partially and weakly reflected; while the other part paſſing through the atmoſphere on its ſurface, will enter into the ſubſtance of the lead; where, they will loſe their properties of light; and becoming *fire*, will *heat* the *metal*.

But if lead be deprived of part of its phlogiſton, by calcination for inſtance, ſo as to form minium, that remaining phlogiſton will be ſmall in quantity, cloſely combined, and much excited; conſequently, it will attract ſurrounding *æther* with more force, than in its metallic ſtate; *which æther* will therefore become more excited; in this ſtate it will repel the *red rays*, becauſe, their æther is in a ſimilar ſtate of *ſtrong* excitement; but the *other* rays will be partly reflected with little velocity, and partly attracted, and condenſed in the lead ſo as to form fire.

Lead when it contains its *full quantity* of *phlogiſton*, is of a bluiſh white colour: when deprived by calcination of part of it, it becomes *greeniſh;* when more calcined, *yellow:* then *orange*, and laſt of all *red;* therefore, the *more phlogiſton* it contains, the *nearer* it approaches the *violet colour*: and the *more* it is *deprived* of that phlogiſton, the *nearer* it gradually approaches, the *other end* of the natural ſcale of colours, till at laſt it becomes of a beautiful red.

The *kind* of rays of light reflected, depends therefore upon the quantity of phlogiſton, whoſe excitement, is *inverſely* proportionate to that quantity: and the quantity of æther naturally ſurrounding the ſurface of that lead, will be excited always *in proportion* to the excitement of that phlogiſton; therefore, as the *æther* forming *different particles* of light, is in *different ſtates* of *excitement*, being the *leaſt* excited in the *violet* rays, and proportionately *more* and *more* ſo to the *red*, 'tis evident, that the more the lead is deprived of its phlogiſton, the more will the remainder be excited, and with it the ſurrounding *æther:* and *that æther*, being *repulſive* to particles of *light* in the *ſame ſtate* of *excitement* from phlogiſton, as itſelf, will *repel* firſt *one* kind of light, and then *another*, in progreſſion; at firſt when little excited, it will reflect the blue rays: when more excited, the green, or yellow: and when at laſt the phlogiſton of the lead is much diminiſhed, and much excited, its ſurrounding *æther* will be in the *ſame violent ſtate* of excitement as the *æther* of the *red rays* are; and conſequently, the *red rays alone* will be *reflected* with their *full force*, or *degree* of *velocity*, upon which their power of exciting the ſenſation of colour, in a great meaſure depends.

Gold, as before mentioned, reflects moſt forcibly the yellow rays; becauſe its ætherial atmoſphere, is in a ſimilar ſtate of excitement, with the æther of the particles of light, forming the yellow rays: therefore, they will be repelled with their full force. But the other rays having their æther more or leſs excited, will not be ſo fully acted upon by the ætherial atmoſphere of the gold, therefore, they will in part, paſs through that atmoſphere, and be attracted into the gold, ſo as to form *fire*; and partly be repelled, but with diminiſhed force, producing a *faintiſh white*, if the yellow rays be intercepted; but if they be not, the *force* with which thoſe others are reflected, being *much diminiſhed*, they will not injure the *more powerful effect* of the *completely reflected yellow rays*; which, will therefore produce the *ſenſation* of a *yellow colour*.

The ſolar rays, undoubtedly contain all the different kinds of particles of light. Theſe compound rays, or beams, when *entire*, give the ſenſation of *whiteneſs*; therefore, every thing which appears white, reflects all kinds of particles, or rays of light.

A body that appears *red*, muſt evidently reflect the red rays: but, it will likewiſe appear blue, green, or yellow, if thoſe kinds of rays be thrown *ſingly* upon it; which ſhews, that a body may *appear red*, though it reflects rays of every other colour, as well as the red ones; and the reaſon muſt be, that the *red rays* are *more perfectly* and *completely reflected*, than thoſe of any other kind; conſequently, their *velocity* and *ſuperior activity* will produce *ſo ſtrong* an *excitement* of the optic nerve, as to render it *incapable* of perceiving the *weaker impulſes* of the *other kinds*, partially reflected, and with diminiſhed velocity.

Bodies containing *no phlogiſton*, ſuch as glaſs, vitrifiable ſubſtances, and many kinds of ſalts, give *no* particular colour: but readily tranſmit through them rays of light of every kind; ſuch kind kinds of ſubſtances, certainly contain the acidifying principle with *æther*, and *that æther* may be naturally ſuppoſed to have a *peculiar attraction* to the *phlogiſton* univerſally preſent, rather than to æther; as appears evident from glaſs, which when rubbed, excites an atmoſphere of phlogiſton to become electric; therefore we may ſuppoſe, that theſe kinds of ſubſtances have an attraction to *phlogiſton* in their natural ſtate, *which* is *gently excited*, and *attracted* to their *ſurfaces*.

The rays of ſolar light, falling *obliquely* upon this phlogiſton, as in experiments with the priſm, are all readily tranſmitted through it, and through the glaſs itſelf; which ſhews, that thoſe rays of light have their *æther* in a *more active ſtate*, *than* their *phlogiſton*; becauſe, they are *not* reflected, but readily tranſmitted; and as *ſome* of *thoſe rays* are *more refracted*, or *bent* from their direct courſe, *than others*, it proves, that *ſome* of them have *their æther* more excited, *than others*. Perhaps the *more excited* the *æther*, the *leſs* will it be drawn from its direct courſe through that phlogiſtic atmoſphere of the priſm, as being of *leſs extent*, and *leſs reſiſted*, as is the caſe with the *red rays*; and the *leſs excited* and *more extenſive* the æther of a particle of light, the *more* will it be *affected* and detained by the ſlightly excited phlogiſtic atmoſphere, and be drawn *ſo much the more* from its direct courſe, or be *ſo much* the *more refracted*, as is the caſe with the *violet rays*.

If light then is compoſed of phlogiſton, and æther in a more active ſtate than that phlogiſton, and ſome rays have their æther more excited than others, 'tis evident, that *phlogiſtic* ſubſtances, attracting the *circumambient æther* to their *ſurfaces*, will *reflect* thoſe rays, more or leſs perfectly. If *all* the rays are reflected, the body will appear *white*; but if *one kind* of rays be *more perfectly* or *forcibly* reflected than the others, the body will appear to be of *that colour*, which thoſe *completely reflected rays* naturally excite.

It appears therefore, that every body which reflects rays exciting the idea of one certain colour, hath its *ætherial atmoſphere* in the *ſame degree* of *excitement*, as the *æther* compoſing *that kind* of rays hath; in conſequence of which, they are reflected *perfectly*, and with their *full velocity*; but thoſe ſubſtances, reflecting *no certain* kind of *colour*, have their ætherial atmoſpheres in a ſtate of excitement, *different* from the degree of excitement, of the *æther* compoſing *any particle*, of *any* of the *different kinds* of light.

Thoſe rays of light which are *imperfectly* and *partially* reflected, will *partly* paſs through the ætherial atmoſphere, *into* the *body itſelf*; where, meeting with the phlogiſton partly compoſing it, they will be *detained*, and *mixed together*, ſo as to loſe their velocity, and properties, *as light*; in conſequence of which, they will combine in a different manner, and form *fire*, as before intimated.

Colouring particles of phlogiſtic matter, *ſuſpended* in *tranſparent liquids*, will act in a ſimilar manner: only inſtead of thoſe particles of light, whoſe æther is in a ſimilar ſtate of excitement with that ſurrounding them, being *reflected* by them, they will in general be *puſhed aſide*, and paſs by them, through the liquid in which they float, and by which they are eaſily tranſmitted; ſo that the *colour tranſmitted*, is *that*, which is excited by *thoſe rays*, *expelled* by the phlogiſtic or colouring particles; and *that light*, or colour, may be reflected through the liquor, by any proper ſurface on the further ſide, ſo as to give the idea of light, or colour reflected by the colouring particles *themſelves*.

Bodies of a *looſe* texture containing a ſuperabundance of phlogiſton, and that ſo little excited, as to have no power of attracting a ſufficiently denſe ætherial atmoſphere around its particles, attract and fix rays of light of every kind on account of their æther; which rays, being confuſedly and forcibly mixed together, in the irregular vacuities of the ſubſtance, will form *fire*; and no part of them being reflected, the matter appears *black*.

But

But thoſe ſubſtances, of an irregular or *looſe* compoſition, and containing æther in a denſe ſtate, or in a ſtate of excitement different from, or greater than that of the æther compoſing any of the rays of light, will repel or reflect thoſe rays of *every kind*, and produce the ſenſation of a *white colour*.

That bodies of all kinds, have an attraction to the æther, or phlogiſton naturally preſent: one or other of which, they always excite in ſome degree or other, to ſurround them in an atmoſpheric form, in their natural or common ſtate, is undoubtedly a fact; for rays of light we ſee, are acted upon, at a conſiderable diſtance from the body by whoſe atmoſphere they are attracted.

But, as a full proof, that bodies do attract atmoſpheres around them, to a conſiderable extent: and that *phlogiſtic* ſubſtances have an *atmoſphere* of a *contrary* nature, or kind, to what glaſs or *ætherial* ſubſtances have: and conſequently, that moſt probably a phlogiſtic ſubſtance attracts an ætherial atmoſphere, and an ætherial body a phlogiſtic one: I need only mention the experiment of expoſing glaſs, and metal to *air* when depoſiting *dew*. The *ætherial* atmoſphere ſurrounding the metal, *repels*, or *drives away* the water in that atmoſpheric ſtate of vapour, ſo that not a particle of it can fall within that atmoſphere, or upon the *metal:* while the *phlogiſtic* atmoſphere, attracted to the ſurface of *glaſs*, attracts thoſe particles of water in their atmoſpheric ſtate, and *condenſes* them upon its ſurface, in the ſtate of *dew* or *water*.

This mode of explaining the fact, that certain bodies reflect rays of one colour, more forcibly or evidently than others of a different kind, is only offer'd as a *conjecture;* all that I at preſent inſiſt upon is, that *light* is *compoſed* of the two active fluids, *æther* and *phlogiſton:* that it is produced when *in certain circumſtances* they unite: that in *other* circumſtances, it is capable of being *decompoſed*, and giving *phlogiſton* to certain earthy ſubſtances, and *æther* to the acidifying principle: and that when *condenſed*, and forcibly crowded in certain bodies,

not

not capable of tranſmitting it, it becomes *fire*, and evidently *heats* the obſtructing body.

Having now given an explanation of the elements, or firſt principles of nature, and the laws by which they act or are governed, and examined then, in the different ſtates of excitement, in which they can exiſt *ſingly*: as well as in their *ſimpler* ſtates of *combination*: I ſhall next conſider, that other very common ſtate of their exiſtence, where, the *four* principles are *mutually ſaturated* with *each other*, ſo as to form that ineſtimable neutral compound, *Water*.

SECTION XIII.

On Water.

WATER is a ſimple neutral fluid, which in different degrees of heat, is capable of aſſuming different appearances, and degrees of ſolidity. If the quantity of heat be diminiſhed to 32°, or below that, of Fahrenheit, its particles attract each other, in a certain mode of arrangement,

ment, and in ſo forcible a manner as to become a *ſolid* body, which is called *Ice;* but if the heat be increaſed to 212°. or upwards, its particles then become repulſive, and expand with great force into the ſtate of *vapour.*

Water is evidently material, and even manifeſtly compoſed of the more fixed principles; yet, it is neither acid nor alkaline: conſequently, it muſt be formed of *acidifying* particles, united with the *earthy principle.*

When the earthy and acidifying particles come into contact, they ſtrongly attract each other, and form a ſolid ponderous compound, ſuch as glaſs; but glaſs is more ſolid and ponderous, and leſs fuſible than ice: and requires a much more violent degree of heat to render it fluid, or evaporate it, than ice does: therefore 'tis natural to ſuppoſe, that the *two fixed principles* compoſing *water,* are *each* accompanied with the *active principle* to which it hath an affinity, excited to ſurround it to a *certain extent:* but not ſufficient to give it ſo *complete* an *atmoſphere,* as to render it aeriform.

Ice will therefore be compoſed of particles of the earthy principle, ſurrounded by *ſmall* atmoſpheres of *phlogiſton*, conſequently in an active ſtate: united to, and conſolidated by particles of the acidifying principle, ſurrounded by atmoſpheres of *æther*, of a *certain extent*, and in an active ſtate; thoſe atmoſpheres firmly attracting, and ſaturating each other, ſo as to form the ſolid neutral compound, *Ice*.

If a quantity of *fire* be applied to this *ice*, it will inſinuate itſelf into *every interſtice*, between thoſe atmoſpheric lines of particles; and by its *general attraction* to the active particles of either kind, when in an atmoſpheric ſtate, it will inſinuate itſelf *between thoſe particles themſelves*, forming thoſe atmoſpheric lines; in conſequence of which, the peculiar attraction by which one *compound particle*, was arranged and attracted to the contiguous particles, ſo as to form a *ſolid*, will be *weakened*: and thoſe reſpective atmoſpheres ſo extended, as to readily admit a *freedom* of *motion* among thoſe compound particles; ſo that they may be moved in any direction, by the ſlighteſt force. In this ſtate of fluidity, they are called *water*.

If now the quantity of *fire* be *much increaſed*, it will inſinuate itſelf ſo *copiouſly between every active particle*, as to increaſe their atmoſpheric extent to a great diſtance from their reſpective centres; in conſequence of which, their attraction to thoſe centres will be greatly weakened, and therefore the attraction between the earthy and acidifying principles muſt be very much diminiſhed; ſo that each fixed principle, will be ſurrounded with atmoſpheres, ſo extended, by the particles of *fire* taken into *arrangement*, and *inſinuated* between the lines of active particles forming thoſe atmoſpheres, that they will be in an *aeriform ſtate*, or that of *vapour*; *each particle* on account of its *widely extended atmoſpheres*, keeping every other at a *conſiderable diſtance*: and having little attraction of union to particles of the oppoſite kind, becauſe the natural excitement of thoſe atmoſpheres are weakened, in proportion as they are removed from their reſpective exciting centres. At the ſame time, thoſe particles of *fire*, by entering into combination with thoſe atmoſpheric particles, *loſe*, in a great meaſure, their peculiar properties as fire, and only reſume them, ſo as to manifeſt their *heating* power, when they *leave that combination*, to enter into bodies poſſeſſing a leſs quantity of them; in conſequence of which, thoſe atmoſpheres will again contract: and the fixed principles will gradually approach, ſo as to regain the ſtate of *water*, and *ice* in progreſſion, as the *igneous particles eſcape*.

To explain the ſubject ſtill further, by a compariſon, the *fixed principles*, being compoſed of *fixed* particles of *matter*, ſurrounded by *inſeparable* atmoſpheres of one, or other of the *active principles*, capable of giving *atmoſpheric* arrangement to *active particles* of the *oppoſite kind*, may be compared to particles of *iron* giving *magnetic* excitement, to one or other of the active principles. The *earthy* principle, with a *ſmall* atmoſphere of *phlogiſton*, will reſemble the magnetic pole, pointing to the *ſouth*; and the *acidifying* principle, with an atmoſphere of *ether*, will be like the magnetic pole pointing to the *north*. A particle of water therefore, being compoſed of a particle of the earthy principle, ſurrounded by ſome phlogiſton, combined with an acidifying particle, exciting a ſmall atmoſphere of æther, will reſemble a magnetic needle: the earthy particle being the ſouth, and the acidifying particle the north end of that compound particle of water. If another particle of water, be brought near to the former, the earthy particle of each, will attract the acidifying particle of the other, by which, they will therefore be *firmly attracted together*, and arranged in an *inverted poſition* with reſpect to each other; the ſame as the ſouth pole of one magnetic needle, will attract and forcibly hold in contact, the north end of another. In this ſtate, the needles will reſemble *ice:* the oppoſite poles being firmly united, and peculiarly arranged, to each other.

If thoſe two particles of ice, be *ſeparated*, or puſhed to a diſtance from each other, by the interpoſition of particles of *fire*, they will reſemble the two magnetic needles, when forcibly ſeparated to a ſmall diſtance; in which ſtate, their mutual attraction being *weakened* by diſtance, they may be eaſily moved, but will ſtill attract each other with evident force; ſo the particles of ice, now mutually attracting with diminiſhed force, are capable of being eaſily moved, from their preſent ſituations with reſpect to each other; in which ſtate, they form that fluid called *Water*.

But were thoſe *magnetic* poles totally ſeparated from each other, by any interpoſing medium combining with their magnetic atmoſpheres, ſo as to *extend* them to ſuch a diſtance, as nearly to *deſtroy* their magnetic excitement: at the ſame time, that *every interſtice* was *filled* with the interpoſed medium: 'tis evident, that they would be made to *recede* from each other, by the preſſure of that medium ſurrounding every pole, and have but *little* power of counteracting that ſeparating force, by the attraction of the oppoſite poles, in that ſtate of debility. So it is with the compound particles of water, when *much fire* is mixed with them; for the interpoſing *fire*, *extends* the *atmoſpheres* of the two *fixed principles*; *weakens* their natural *excitement*, and *ſeparates* them nearly into *diſtinct particles*,

cles, each ſurrounded by its reſpective *atmoſpheres*, *extended* and *turgid* with the particles *of fire* interpoſed, and connected with thoſe atmoſpheres; in conſequence of which, *each particle* muſt be *forced* to a *diſtance*, from *every other*, and the *phlogiſtic fiery atmoſphere* of the *earthy particles*, will have but *little tendency* to *unite*, with the *ætherial atmoſpheres* of the *acidifying particles*, as *replete* and *ſaturated* with *igneous particles* as themſelves: therefore, the particles of the water, will expand into the ſtate of vapour.

'Tis evident alſo, in this ſtate of vapour, where the *fixed* principles, compoſing water, are ſo *ſeparated*, as to have ſcarcely any connection, that they may be readily decompoſed; which in fact may eaſily be affected, and is a proof of the veracity of the principles propoſed.

For inſtance, *iron* is compoſed of *earthy* particles, rendered metallic, and connected together by means of much *phlogiſton*. If this phlogiſton be *extended*, and its attraction to thoſe earthy particles

cles *weakened* by means of *fire*, and in that ſtate be expoſed to the action of *water*, in the violent ſtate of *vapour*, by means of *fire* diſuniting its component fixed principles, and rendering them *aeriform*, by combining with and extending their reſpective atmoſpheres of active particles, 'tis evident, that the *phlogiſton* of the iron, will attract the *ætherial* atmoſpheres of the acidifying particles compoſing the water, by which thoſe *acidifying* particles, will be drawn into *contact* with the *earthy* particles of the *iron*, and attracted by them: in conſequence of which, thoſe earthy particles will loſe their attraction to their *phlogiſton*, which will be *expanded* and eagerly *attracted* by the *earthy-particles* of the *water*, now rendered *powerfully active*, by *loſing* thoſe *acidifying particles* attracted by the earth of the iron, with which *they were* before *combined* and *ſaturated;* but now being entirely ſeparated from them, theſe *earthy particles* of the *water*, thus left with *ſmall*, *unſatisfied*, and *active atmoſpheres* of *phlogiſton*, will eagerly *attract* into *arrangement*, the *phlogiſton diſplaced* from the earth of the *iron*, ſo as to ſurround themſelves with complete phlogiſtic atmoſpheres; by which they will acquire an *aeriform* ſtate, and become poſſeſſed of thoſe properties, which diſtinguiſh them to be *inflammable air*.

It appears therefore, that when violently heated, the attraction of the *earth* of iron, to the *acidifying* particles of water, in an *active* ſtate, and of the *earth* of water not ſaturated with phlogiſton, to the *phlogiſton* of iron, together, are *ſtronger*, than the united attractions of the *earth* of iron to its *phlogiſton*, and of the *earthy principle* of water, to the *acidifying principle; each fixed principle* being in an *active* ſtate, and, by means of *fire*, *ſeparated*, ſo as *not* to be capable of ſaturating or ſatisfying each other.

Heated iron therefore, expoſed to water in the ſtate of vapour, will attract the *acidifying particles* of *that water*, and form a calx or ſlag; and at the ſame time, will give its *phlogiſton* to the diſengaged active *earthy particles* of the *water;* which, attracting that phlogiſton around them, will become *aeriform*, or poſſeſſed of complete atmoſpheres, ſo widely extended, as to be no longer evidently excited, or poſſeſſed of alkaline properties; in which ſtate, they are called inflammable air.

Water therefore, is compoſed of the *acidifying principle*, ſurrounded with a *certain* quantity of *æther*, which *æther* is in that ſtate of excitement, which is called *acid*, being ſtrongly attractive, either to phlogiſton in a ſimilar ſtate, or to diſengaged particles of *æther* themſelves; ſo that the æther ſurrounding each acid particle, by its *attraction* of *arrangement*, will attract æther ſufficient to invelope every particle with a complete atmoſphere, by which they acquire the properties and name of pure air.

Thoſe particles, in this acid, or active ſtate, combining with particles of the *earthy principle* in a ſtate of great activity, mutually attract and ſaturate each other, ſo as to form that neutral compound, *water;* for the *earthy particles*, thus ſatisfying the acidifying particles, are each inveloped in a *ſmall atmoſphere* of *phlogiſton*, which in that ſtate, gives them the properties which are called *alkaline;* having a ſtrong attraction to *acids*: and alſo a power of taking into *arrangement,* ſo *great* a *quantity* of *phlogiſton,* as to give them the ſtate and properties of *inflammable air.*

Pure air is therefore compoſed of acidifying particles, *fully* ſaturated with, and ſurrounded by *complete* atmoſpheres of æther; and inflammable air, of particles of the earthy principle, rendered aeriform, by *perfect* atmoſpheres of phlogiſton; each being in a great meaſure inactive, on account of the great extent of its atmoſpheres, which become leſs excited as their diſtance from their reſpective actuating fixed principles, as centres, increaſes.

If theſe two airs, or gaſes be mixed together, and their reſpective atmoſpheres of æther or phlogiſton be ſtill *further extended* by means of *fire,* or any ignited body, the *external* and *leſs forcibly attracted* particles of *thoſe atmoſpheres,* will unite, and *ſeparate* from their reſpective centres; and in that ſtate, they will form *fire,* or *light,* or *both,* and eſcape; and at the ſame time, the fixed *earthy* and *acidifying* principles, *each* ſtill retaining a *certain* portion of thoſe *external* atmoſpheres, by which they were ſurrounded, and which, to a certain extent, they too powerfully attract, to be *eaſily* ſeparated from, are by thoſe remaining atmoſpheric particles attracted to unite, and form *water*.

The indefatigable, and juſtly celebrated Dr. Prieſtley, hath lately doubted the production, or generation of water, by exploding pure and inflammable airs together; becauſe, in his Experiments, the fluid reſiduum, was not *pure water*, but evidently contained *ſome acid*. But thoſe Experiments, in reality prove no more than this, that the quantity of inflammable air, neceſſary to ſupply *phlogiſton* ſufficient to ſaturate the *æther* of the pure air employed, did *not* contain *enough* of the *earthy principle*, depoſited by that phlogiſton, to *ſaturate* the *acid particles* ſeparated from the æther of the pure air; or, that the quantity of phlogiſton in inflammable air, is in *too great* proportion to the æther in pure air; in conſequence of which, the acidifying particles are too much deprived of their æther, and the remainder is in that ſtate of activity, which conſtitutes acidity. So that if the proportion of phlogiſton be too great, or of the earth too ſmall in the inflammable air employed, the acidifying particles will be left too active, or not ſaturated, and the compound reſiduum will be *water* with a *ſlight acidity*.

And that this diſproportion, is the cauſe of the *acidity* of the water generated, is abundantly evident, from comparing the *quantity* of *acid* found in Dr. Prieſtley's Experiments, with the *much greater quantity*, which the *ſame meaſure* of *pure air* would have depoſited, had it been decompoſed by *phoſphorus*. For in the Drs. Experiments, 500 ounce *meaſures* of *pure air* only afforded as much acid as was equivalent to 12. 54 grains of concentrated acid of vitriol; which quantity of acid is capable of ſaturating as much vegetable alkali as is contained in 22½ grains of nitre cryſtallized in mean temperature. The ſediment of the ſame liquor was alſo ſuppoſed to contain, at leaſt, as much acid as the liquor itſelf. So that the whole quantity of acid depoſited may be ſuppoſed to be equal to about 25 grains of concentrated vitriolic acid.

The 500 Ounce meaſures therefore of pure air, by combuſtion with inflammable air, depoſited ſo much acid as was equivalent to about 25 grains of vitriolic acid, which would ſaturate about 15 grains of ſoda: but had that quantity of pure air been decompoſed by combuſtion with *phoſphorus*, it would have depoſited about 380 grains of *acid*, which would have ſaturated upwards of 1000 grains of ſoda.

But in Dr. Prieſtley's experiments, that quantity of pure air, when decompoſed by inflammable air, produced only 25 grains of acid, in the liquor and ſediment; which together, if we ſuppoſe of the *ſame kind*, and ſtrength, as that generated by combuſtion with phoſphorus, would only ſaturate 70 grains of ſoda: therefore, as the whole quantity of pure air is nearly equally decompoſed in both caſes, the other 355 grains of acid muſt be contained in the *liquor produce*d by the operation; where being *not evident*, as *an acid*, it muſt be combined to ſaturation with *ſomething* capable of neutralizing it; and that ſomething muſt either be *æther*, or *earth*, or *both*; but if it were æther, the acid would ſtill be aeriform which it is not, therefore, it muſt at leaſt in part be the *earthy principle*, in a ſtate of great activity, or in that ſtate which we call *alkaline*; and *that earthy principle* in its *alkaline* ſtate, muſt be ſupplied by the 1000 ounce meaſures of *inflammable air* employed in the experiment, *partly* deprived of its *phlogiſton*, by that phlogiſton's uniting with the æther of the pure air and producing light and fire; in conſequence of which, the *earthy principle* with its *active* reſiduum of *phlogiſton*, combines with the *acidifying principle* with its *active* reſiduum of *æther*, and forms *water*.

But 1000 ounce meaſures of inflammable air, weighing about 60 grains, exploded with 500 ounce meaſures of pure air weighing about 380 grains, produce about 440 grains of water, containing about 25 grains of acid; conſequently, if thoſe 25 grains of acid are abſtracted, the remainder will be *water* in its perfect, or *neutral* ſtate.

It appears therefore, that if the 25 grains of acid furniſhed by the pure air, be deducted from the weight of the pure air employed, the remainder of that pure air, about 355 grains muſt enter into the compoſition of the water. Of what do thoſe 355 grains conſiſt?—If 100 grains of pure air be decompoſed by phoſphorus, the phoſphorus will gain 100 grains in weight, and thoſe 100 grains are *acid*, and capable of ſaturating 280 grains of ſoda: conſequently, the weight of pure air is that of its *baſe*, and *that baſe* is *acid*; therefore, the 355 grains, entering into the compoſition of the water, in the former experiment, are 355 grains of acid: and that quantity is combined with the *baſe* of the *inflammable air*, and neutralized ſo as to form *water*. But an acid can be neutralized, or diſpoſſeſſed of its acid properties, by nothing but the *earthy principle* in an active or alkaline ſtate, or by *æther*; therefore, the baſe of inflammable air is an *earth*.

But the inflammable air only weighed about 60 grains, therefore could not afford more than 60 grains of earth to combine with, and ſaturate thoſe 355 grains of acid: conſequently, the proportion of the earth to the acid in water, cannot be greater than about 1 to 6. But, *water* is a *neutral* fluid, neither evidently acid nor *alkaline:* therefore, the *acid* compoſing it, muſt be *partly ſaturated* with the *earthy principle* in an *active* ſtate, and *partly* with *æther*.

But, from Mr. Kirwan's Experiments, pure air it ſeems may contain about one eighth of its weight of water, and inflammable air about one half; therefore, if thoſe proportions be deducted, the 355 grains of pure air, will be found to contain about 310 grains of acid, and the 60 grains of inflammable air, about 30 grains of earth; which uniting, will form water, and mix with that which they contained already formed.

Water therefore, in reality, ſeems to be compoſed of a greater number of acid than of earthy particles; the proportion, without pretending to aſcertain it, may be ſuppoſed, for conveniency, to be 10 of the former, to 1 of the latter; and conſequently, the ætherial particles forming atmoſpheres around thoſe acidifying particles, muſt be *ſo far extended*, as to have only about *one tenth* of the *activity* or *excitement*, which the *phlogiſtic particles*, ſurrounding the earthy particles to a proportionately leſs extent, have: by which proportion, the *activity* of thoſe *ætherial* particles, will be ſo *diminiſhed*, as to render their acidity imperceptible; and the water they compoſe, by combining with the *more active phlogiſton* of the earthy particles, will ſtill be *neutral*.

When water contains but *little fire* in its interſtices, *each earthy particle* with its ſmall phlogiſtic atmoſphere, if unaccompanied with other earthy particles, would attract 10 *particles* of the *acidifying principle*, to its ſurface; and they would arrange themſelves around it, in angles of about 60 degrees, ſo as to equally divide the ſurface of that atmoſpheric earthy particle amongſt them; and in that caſe, the external phlogiſtic atmoſphere of the earthy particle, would unite with the external ætherial atmoſpheres of the acidifying particles, and draw each of them towards it, till their reſpective *internal eſſential* atmoſpheres came into contact; by which, they would become firmly fixed to each other, in that particular mode of arrangement, ſo as to form a ſolid particle of *Ice*.

It appears therefore, when a number of acidifying particles with ætherial atmoſpheres, of moderate extent and excitement, are mixed with a ſmaller number of earthy particles, with phlogiſtic atmoſpheres, of leſs extent and greater excitement, in a certain proportion, that they counteract each other, ſo as to produce a *neutral* compound.

If theſe neutral or compound particles, be mixed with a number of *igneous* particles, ſufficient to weaken their mutual attraction by expanding their atmoſpheres, each *earthy* particle, will be ſurrounded, by its proportion, of the *acidifying* particles, moderately attracted to its ſurface; but not ſo firmly united, but, that every particle can be moved with the gentleſt force; ſo that the whole, will be in that ſtate of *fluidity* which we call *water*. In this ſtate, each acidifying particle being ſurrounded by *ætherial* rays, extending in all directions, *thoſe* on *that ſide* next its *particular earthy centre*, will be attracted with conſiderable force, by the *phlogiſtic* atmoſphere of *that centre*; while *thoſe* extending *outwardly*, or in a contrary direction, will attract the *phlogiſtic* rays of the *neighbouring earthy centre*, extending *through that ſpace* left between the acidifying particles, (attractedat certain angles, or diſtances to that ſurface,) *which* is oppoſed to thoſe ætherial rays: in conſequence of this, the particles of water, have a *mutual attraction* to each other.

If the quantity of *fire*, commixt with theſe particles, be *diminiſhed*, till the reſpective atmoſpheres ſurrounding each particle, be ſufficiently contracted and active, the phlogiſtic atmoſpheres of the earthy centres, will gradually attract the ætherial atmoſpheres of the ſurrounding acidifying particles, till their reſpective *internal*, or *eſſential* atmoſpheres come into contact; when, they will be *ſuddenly* and *violently* drawn into *cloſe union*, ſo as to become a *ſolid*, or *ice*; and the fire, before connected with thoſe atmoſpheres, will become *diſengaged* and be *expelled.*

But in the ſtate of water, the particles were ſo ſlightly connected, as to move in any manner, or direction, ſo as to give the moſt ſpace to the moving body, and occupy the leaſt room; but now, each atmoſphere acquiring its proper force, by becoming diſengaged from the interpoſing particles of fire, a certain *arrangement* takes place, at the moment of congelation; every *earthy* centre *attracts* and *firmly fixes* its proper number of *acidifying* particles to its ſurface, at certain *angles* or *diſtances* from each other; and as the ætherial atmoſpheres of thoſe diſtant acidifying particles, attract the phlogiſtic rays of the neighbouring earthy particles, extending from the *ſpaces* between *their* reſpective acidifying particles, 'tis evident, that at this moment of congelation when each acidifying particle becomes fixed in its proper place, to its own proper centre, that it will attract the neighbouring particle of water, to arrange itſelf ſo, that it may attract the centre of the unoccupied *ſpace*, or *that part* of the neighbouring earthy particle, which is *moſt diſtant* from the acidifying particles *properly* ſurrounding it; and in *that poſition*, or *mode* of *arrangement*, the two particles will become *firmly united*, and capable of taking *others* into a *ſimilar* arrangement, ſo as to form a *ſolid maſs* of *ice*.

But, if the water, inſtead of being robbed of the quantity of fire neceſſary to its fluidity, be expoſed to the action of a *ſtill greater* degree of heat, equal to 212° or upwards, that increaſed quantity of fire, will diſtend every atmoſphere, of every particle compoſing that water, and enter into atmoſpheric arrangement with them, by attracting and inſinuating itſelf, between every active particle, forming thoſe atmoſpheres of either kind; by which, they will be ſo extended, and their activity ſo weakened, that their reſpective fixed centres, will be very far removed from each other; and the contrary kinds of particles, forming each particle of water, will be but *ſlightly connected*.

When the quantity of fire becomes ſo great, as to *expand* thoſe atmoſpheres to a *certain extent*, the ætherial atmoſpheres extending from the ſurrounding acidifying particles of *one* particle of water, will loſe *their* power of attracting the phlogiſtic rays extending from the central earthy particles of the *neighbouring* particles of water; partly on account of each atmoſpheric ray being *weakened* by extenſion, and partly by the ætherial atmoſphere of each acidifying particle, ſurrounding each earthy centre, being ſo *turgid* and *expanded*, as to *preſs* upon *each other*, and fill up *thoſe ſpaces* naturally left between them in their ſtate of water; by which, the *egreſs* of the *phlogiſtic rays* extending from each reſpective earthy centre, will be *perfectly intercepted*, and every attraction between the particles of water muſt ceaſe; and each compound particle of water, being thus *prevented* from having *any attraction* to thoſe near it, the turgid atmoſpheres of each, at *that moment* when every counteracting attraction of conſolidation ceaſes, will *inſtantly* and *forcibly expand*, and *recede* to their *full extent* from each other, ſo as to aſſume the ſtate of *vapour*.

At the very moment too, when thoſe *atmoſpheres* ceaſe to be confined by the attraction uniting one particle of water to the other, they will attract into arrangement a number of the particles of *fire*, which before were only crowded into the interſtices of the lines of particles forming thoſe atmoſpheres; by which, they will become ſtill more extended, and expand into the ſtate of vapour; and the quantity of *active fire* or *ſenſible heat* will be *diminiſhed*, by the number of its particles attracted by thoſe atmoſpheres into combination with them; in which ſtate, the igneous particles muſt loſe conſiderably of their activity, and become *latent*: till thoſe atmoſpheres be again contracted ſo far, that one compound particle can attract another, and become water; by which attraction, the atmoſpheres will be condenſed, the fixed centres approximated, and the interpoſed particles of fire preſſed out, ſo as to flow off in their active diſengaged ſtate, and produce ſenſible heat.

It appears therefore, when for the ſake of giving a general idea of *water*, I compared one of its particles, compoſed of the earthy and acidifying principle in active ſtates, to a needle, rendered magnetic by having all its phlogiſton excited at one of its ends, and all its æther to the other, that the compariſon was not ſtrictly juſt; for although the particles of water are held together, by means of the phlogiſtic atmoſphere of the earthy principle of one, attracting the ætherial atmoſpheres of the acidifying particles of others, as before aſſerted, yet there is this difference, that inſtead of a particle of water being formed of one earthy particle, united to one acidifying particle, ſo as that each may form one end of the particle of water they compoſe, the earthy particle with its atmoſphere of phlogiſton, reſembling the ſouth pole, and the acidifying particle with its ætherial atmoſphere the north pole of a magnet, in reality, *each earthy particle* with its excited *phlogiſtic* atmoſphere, is ſurrounded on every ſide by a certain number of *acidifying* particles, actuated by *ætherial* atmoſpheres; and thoſe acidifying particles are arranged to that earthy centre at *certain angles* with reſpect to each other.

Suppoſe the angle formed, by the rays extending from any two acidifying particles to that earthy centre, be 60°. thoſe *two* particles with their *ætherial* atmoſpheres, and the *phlogiſtic* atmoſphere of the earthy particle in the centre, will reſemble an iron rod of a certain length and proper thickneſs, having an *ætherial magnetic* atmoſphere at *each end*, and a *phlogiſtic* one in the *centre*, particularly, if it be bent at its centre to an angle of 60°. If another rod of the ſame ſize and figure, and in a ſimilar ſtate of excitement, be brought near and parallel to it, 'tis evident, that it cannot be attracted: but if either of its *ætherial* ends be brought into the *middle* of the *ſpace* between the two ends of the former, it will *paſs between* them, and be *attracted* to their *phlogiſtic centre.* In like manner, the *acidifying* particle of one particle of water, will paſs between the ætherial atmoſpheres of any two acidifying particles partly compoſing another, and its *own ætherial* atmoſphere will be ſo attracted by the *phlogiſtic* atmoſphere of the *earthy centre* of the others, that it will be *held* in that *certain poſition*, or *arrangement*; and be immoveablyfixed there, if the quantity of fire be not ſo great, as to prevent their *internal* atmoſpheres, from being drawn into contact.

Water appears therefore, evidently to be compoſed of particles of the earthy principle, with ſmall atmoſpheres of phlogiſton in a very active ſtate, combined with a greater number of acidifying particles, with more extended atmoſpheres of æther, conſequently, in a leſs excited ſtate, than the phlogiſton of the earthy particles with which they are united: the greater activity of the phlogiſton, making up for the deficiency of the number of earthy particles, ſo as to enable them to ſaturate thoſe acidifying particles, and form with them this neutral fluid, water. Their proportions I at preſent have not data ſufficient to enable me to determine.

The decompoſition of water when violently expanded by means of fire, ſo as to be in the ſtate of *vapour*, or *ſteam*, by iron made hot; ſufficiently proves theſe principles; for the earth of the iron attracting the acid of the water, becomes a calx, and at the ſame time gives out its *phlogiſton*, which is ſeized upon by the active *earthy* particles of the water, then perfectly diſengaged, and attracted by *them* into arrangement, ſo as to form *complete phlogiſtic atmoſpheres* around them; by which, they become expanded into *inflammable air*. The additional weight acquired by the earth of the iron, and the weight of the inflammable air produced, together, being equal to the weight of the water diſappearing.

And as a further proof, I ſhall juſt mention the production of *pure air*, when pure nitrous acid is expoſed to the action of *light*.

Nitrous acid is evidently compoſed of water, with a ſuperabundance of acidifying particles with ſmall ætherial atmoſpheres; conſequently, in an active, or acid ſtate. In this compound, the acid particles ſtrongly attract the *earthy* particles of the *water*; in conſequence of which, they muſt retain their proper acidifying particles with a force *leſs* than natural. In that ſtate, if they be expoſed to *light*, which is a compound of æther and phlogiſton, thoſe acidifying particles will attract the æther of the light; and the phlogiſton ſeparated from that æther, will be attracted by the earthy particles, which, by being thus ſatisfied with phlogiſton, will loſe their attraction to their natural acidifying particles, at the very moment when thoſe acidifying particles attract æther from the light, ſufficient to give them *complete atmoſpheres*, and enable them to *expand* and become *pure air.*

Thoſe earthy particles, with their acquired phlogiſton, will be attracted by the particles of nitrous acid, and diſſolved or equally diffuſed among them.

Water is produced, when pure air, which is certainly compoſed of particles of the acidifying principle, and æther, and inflammable air, which is compoſed of particles of the earthy principle with phlogiſton, are mixed together in certain proportions, and exploded: it is decompoſed when iron, in proper circumſtances, attracts its acid, and at the ſame time gives out *phlogiſton* enough to ſurround its *earthy particles*, with complete atmoſpheres, which in that ſtate become *inflammable air*: and it likewiſe is decompoſed by nitrous acid, which attracts its earthy particles, if at the ſame time its *acidifying particles* can meet with *æther*, enough to give them ſufficiently extended atmoſpheres; as is the caſe when the mixture of nitrous acid and water, is expoſed *to* the action of *light*, with room to expand; in which caſe, the *acidifying particles* of the water, will reſign their earthy particles to the nitrous acid, and attracting the *æther* of the *light*, will expand and become *pure air*; the diſengaged phlogiſton of the light being at the ſame time attracted by the earthy particles of the water, and equally diffuſed amongſt the nitrous acid: conſequently, *water* is compoſed of particles of the *earthy principle* with *phlogiſton*, united to *acidifying* particles with *æther*, mutually ſaturating each other: where, however, the *acidifying* particles ſeem to be *moſt numerous*, and their *ætherial* atmoſpheres *moſt extended*; and conſequently, *leſs active* than the phlogiſton ſurrounding, and actuating the earthy particles with which they are combined.

I have now explained what I mean by the elements of nature; and attempted to demonſtrate their exiſtence; to point out the general ſimple properties which each is poſſeſſed of, and to ſhew, that thoſe ſimple elements and properties, ſingly, or combined, produce thoſe powerful agents of nature, whoſe wonderful effects ſtrike us with awe, or fill us with admiration!

I ſhall here therefore conclude the ſubject; but for the ſake of bringing the whole, as much as poſſible, into one point of view, ſhall add the following Recapitulation.

Recapitulation.

1. EVERY thing is compoſed of *matter*, actuated by the property of *attraction;* by which alone all the operations and phenomena of nature are produced.

2. Matter is of two kinds, one of which may be called *fixed*, and the other *active*.

3. Particles of *fixed* matter have no property but *impenetrability*, and *general attraction:* but,

4. Particles of *active* matter, when attracted by particles of fixed matter, become excited to attract

each other into *arrangement*, ſo as to form *lines* extending like *radii* around the fixed particles; and receding from each other as their diſtances from thoſe fixed centres increaſe, ſo as to form expanded *atmoſpheres* around them.

5. The particles of *active* matter are of *two kinds*, each being equally attracted by fixed particles, and in conſequence of that, excited to attract particles of its own kind, into *atmoſpheric arrangement*. One kind of theſe active particles I call *Æther*, and the other *Phlogiſton*.

6. *Fixed* particles of matter, ſurrounded by atmoſpheres of *æther*, will form *compound* particles, which cannot be decompoſed, becauſe that æther can never be attracted with greater force, by any thing, than by the fixed particle which it already is united to: theſe compound particles being therefore *indeſtructible*, will form a *fixed*, or *ſolid* principle; which I therefore call the *Earthy principle*.

7. In like manner, *fixed* particles of matter attracting atmoſpheres of *phlogiſton*, will produce the indeſtructible compound particles, which form the *acidifying principle*.

8. The *active* particles of matter, beſides this attraction of arrangement amongſt ſimilar particles, when excited to become atmoſpheric around fixed centres, have likewiſe an *attraction mutually* to *each other*, when in ſimilar ſtates; by which, their particles move into union from their circumferences, *progreſſively* to their centres, until thoſe reſpective fixed centres are drawn into contact. This attraction between atmoſpheres of the different active particles, drawing and holding their fixed centres together, is called the *Attraction* of *Coheſion*: therefore,

9. Particles of the *earthy* principle, by means of the ætherial atmoſpheres eſſential to them as principles, will attract the phlogiſtic atmoſpheres, of particles of the *acidifying* principle, by which their reſpective fixed centres will be drawn into contact, ſo as to form a ſolid maſs.

10. Æther and phlogiſton being univerſally diffuſed, in their unexcited fluid ſtate, are capable of penetrating between the lines of active particles, arranged around fixed particles, or fixed principles; in conſequence of which, one, or both will receive a certain degree of excitement from every fixed particle, or fixed principle; which excitement, will cauſe them to attract ſimilar particles to arrangement, and form lines of ætherial, or phlogiſtic particles, which would extend in all directions, far as creation itſelf, if they were not to meet with rays of the oppoſite kind, in a ſimilar ſtate of excitement, from other bodies. But when rays of æther, or phlogiſton, excited by the fixed particles of *one* body, meet with lines of the contrary active particles, excited by *another*, they will *draw* thoſe bodies into contact: the greater the number of *fixed* particles, the greater will be the number of *active* particles thus excited; and conſequently, the more powerful their attraction. Thus is produced the *Attraction* of *Gravity;* by which every maſs of matter is connected with every other.

11. Fixed particles of matter, give to active particles their excitement, by which the active particles of one kind, become attractive to thoſe of the other; conſequently, the attraction between fixed and active particles when in contact, is moſt powerful: but, as that attraction is weakened by diſtance, thoſe atmoſpheres, at a certain extent from their fixed centres, will begin to have a *greater* attraction of *union* to active particles of the *other* kind, *than* of *arrangement* to *ſimilar* particles; in conſequence of which, they will attract an *external* atmoſphere of the *oppoſite kind*, rather than extend themſelves, by taking *more* particles of *their own kind* into arrangement Therefore.

12. The *ætherial* atmoſphere ſurrounding a particle of fixed matter, ſo as to form a particle of the *earthy* principle, when of a *certain extent* around that fixed particle, will attract an atmoſphere of *phlogiſton*, by which it will acquire the property which is called *Alkaline;* if that phlogiſtic atmoſphere be fully, or widely extended, its excitement will be ſmall, and its alkaline proper-

ty ſcarcely evident; but, if it be of little extent, the particles will be powerfully alkaline.

13. In like manner, the *phlogiſtic* eſſential atmoſphere of a particle of the *acidifying* principle, of a certain extent, will invelope itſelf, with an external atmoſphere of *æther*; which will manifeſt its activity, by a proportionate degree of that property called *Acidity*.

14. The *eſſential* atmoſphere of every fixed particle of matter, rendering it a *fixed principle*, being at ſuch a diſtance from its exciting centre, as to have its attraction to the oppoſite active fluid, greater, than its attraction of arrangement to ſimilar particles, will *attract thoſe* particles of a *contrary* kind, into *arrangement* around them; and to a *certain extent*, *their* attraction of *arrangement*, will be *greater* than their attraction of *union*, to the *contrary* active particles.

15. A particle of *either* of the fixed principles, will therefore, if poſſible, ſurround itſelf with an atmoſphere of the oppoſite kind of active particles, to *that extent*, where the attraction of arrangement, *ceaſes* to be moſt powerful; in which ſtate, the particle becomes *aeriform* Conſequently,

16. An earthy particle, with its *full external* atmoſphere of phlogiſton, or in the ſtate of inflammable air, will not ſenſibly act upon a particle of the acidifying principle, with a complete atmoſphere of æther, forming a particle of pure air; becauſe, each is in *that ſtate*, in which, their *external* particles have *no decided tendency*, either to *arrangement* with *ſimilar* particles, or to *unite* with the *oppoſite* kind. But,

17. If thoſe external atmoſpheres be *extended* by heat or *fire*, with that increaſed diſtance, from their reſpective centres, they will acquire a tendency to *unite*, as being removed to *that diſtance* from thoſe reſpective centres, *where*, the *attraction* of *union*, *exceeds* the force of arrangement.

18. A particle of the earthy principle, with a *partial*, or *ſmall* external atmoſphere of *phlogiſton*, will, therefore, be in that ſtate of activity which we call *alkaline*; having an attraction of *union* to the acidifying principle, whoſe æther is in a ſimilar active, or acid ſtate, but having a *ſtill greater* attraction of *arrangement* to phlogiſton, which if it can meet with, in proper circumſtances, diſengaged, it will attract, in preference to the acidifying principle: as is the caſe when water in the ſtate of *ſteam*, is expoſed to the action of *iron*, properly heated; the *earthy* particles of the water, will ſeparate from the acidifying particles with which they were combined, to attract into arrangement *complete atmoſpheres* of *phlogiſton*, from the iron; by which the earth of the iron, will be left to unite with the acidifying particles of the water, and the earthy particles of that water with their complete phlogiſtic atmoſpheres, will expand and become *inflammable air*. So likewiſe, when the *earthy* particles of water, are attracted by nitrous acid, its *acidifying* particles will attract into ar-arrangement, the *æther* of *light*, and become *pure air*,

air, *rather* than remain united to the earthy particles. Therefore,

19. When thoſe external atmoſpheres of the earthy and acidifying principles, are *very ſmall*, and very active, they will unite, and draw their internal atmoſpheres into contact, and union alſo, ſo as to form neutral compounds, if each be in proper proportion: If they be each of *moderate extent*, when their external atmoſpheres are drawn into contact, and ruſh into cloſer union, *part* of thoſe external atmoſpheres will be *diſengaged*, and unite and eſcape: but, if each be *widely* and *fully extended*, they will be ſo inactive as to form no union with each other, capable of ſeparating them from their preſent connexions; unleſs by means of *fire*, they be ſo far removed from the centres by which they are reſpectively attracted, as to acquire an attraction of union, greater, than that of arrangement: in which caſe, part, or all of both will unite and form fire, or light; and the more active remaining particles of each, if any remain, being ſtrongly retained by their fixed principles,

will unite alſo, and draw thoſe centres into combination; as is the caſe with pure and inflammable air, when by means of fire, they combine and produce Fire, Light, and Water.

20. No fixed principle will part from its external atmoſphere, unleſs it can acquire the oppoſite fixed principle, to attract and ſatisfy it, in the place of its active principle diſengaged; neither will that active atmoſphere, ſeparate from its fixed principle, unleſs it can meet with the other active principle wherewith to combine, at the ſame time, that their reſpective fixed principles unite: unleſs the principles be diſproportionate, in which caſe, the *active* principle diſengaged from *one*, may be attracted to *arrangement* around thoſe particles of the *fixed* principle of *another*, to which it hath an affinity, ſo as to give them *complete atmoſpheres* and render them *Aeriform*.

21. *Compound bodies*, may contain both the fixed and active principles, in ſuch proportions, as to have a ſtrong attraction, to *both æther* and *phlogiſton* in their common ſtate; in which caſe, they will reſemble two *fixed particles* of matter, ſurrounded with a *compound* of æther and phlogiſton; if the æther were excited particularly to ſurround one fixed particle, the other, being deprived of its ſhare of that æther, would exert its *full force*, upon the phlogiſton, and attract it around itſelf. Thus,

22. *Iron*, is ſuch a compoſition, that it naturally attracts *both* æther and phlogiſton. If *one* of thoſe active fluids be excited at *one* end of a rod of iron, it will attract all the ſimilar particles, near it, into arrangement; while the *other* fluid will become *more* powerfully attracted, at the other end of the rod, than uſual, by the whole attraction of that end, being then exerted upon *it alone*; therefore, it will form an atmoſphere at that end, and the rod will become *magnetic*.

23. If the *ætherial* end of this magnet, be applied to the end of another iron rod in its natural ſtate, it will attract and excite all the *phlogiſton* of that natural rod to *that end*, and all its *æther* will recede to *the other*, and form an ætherial atmoſphere; in conſequence of which, this ſecond rod will become a *magnet* alſo.

24. The ætherial pole therefore, is like a particle of the earthy principle, as being a fixed centre with an atmoſphere of æther; inſeparable, on account of the ſtrong natural attraction of the iron: and the phlogiſtic pole, will reſemble a particle of the acidifying principle. The oppoſite poles, like the contrary principles, ſtrongly attracting each other, but refuſing every connexion with ſimilar poles.

25. Theſe two different *magnetic* atmoſpheres, cannot *ſeparate* from their reſpective poles, by *uniting*, becauſe, they *both* are *equally* attracted by the iron, *either ſingly*, or *combined:* therefore, their attracting each other, does *not prevent* their being *ſtill attracted*, and *retained*, by the *iron*.

26. *Compound bodies*, containing *either* æther, or phlogiſton in a ſtate of ſome activity, in ſome meaſure reſemble the *fixed principles*, as having an *attraction* to *active particles* of the *contrary kind*; and by a proper excitement, they may be made to attract thoſe *oppoſite* particles, into an *atmoſpheric* form around them. For inſtance,

27. *Sulphur*, contains much phlogiſton; and being always naturally ſurrounded by both æther and phlogiſton in their *common* ſtate, when its ſurface is excited, it will attract an atmoſphere of *æther*; and the phlogiſton, naturally combined with that æther, by being thus ſeparated, will become equally excited; but the ſulphur hath no attraction for *phlogiſton*, therefore it muſt *unite* itſelf to the *ſurface* of the *rubber*.

But in this caſe, the quantity of *æther* being great, and the degree of excitement, which the phlogiſton of the ſulphur is capable of giving, being ſmall, the attraction of arrangement of *that æther* muſt be leſs, than the attraction of union to

phlogiſton;

phlogiſton; as being *extended further* from the exciting ſurface, *than where* the attraction of arrangement, *ceaſes* to be *moſt powerful*: in conſequence of which, its external particles will ſtrongly attract the external particles of the phlogiſton ſeparated from it, or excited to the ſurface of the rubber; and when that union is deſtroyed by the ſeparation of the rubber, from the ſurface of the ſulphur which it excites, the attraction of union, of the æther, to the oppoſite principle, being *left* in *full force*, it will immediately attract an *external atmoſphere* of *phlogiſton*, from the æther and phlogiſton ſupplied by ſurrounding bodies, in their common ſtate; which phlogiſton it will take along with it: at the ſame time, that the *phlogiſton* excited to the *rubber*, will ſurround itſelf with the *æther*, diſengaged from *that* phlogiſton which now forms the *external* atmoſphere of the *ſulphur*: ſo that the *ſulphur* will have attracted to its ſurface, an atmoſphere of æther ſurrounded by another of phlogiſton, and be negatively electrified; while its rubber, will poſſeſs an atmoſphere of phlogiſton, with an external one of æther, and be poſitively electrified.

28. *Glaſs*, on the contrary, by friction, will attract to its ſurface an atmoſphere of *phlogiſton*, which will aſſume an external atmoſphere of *æther*; while the oppoſite active principles, ſeparated from thoſe, will form an *electric* atmoſphere of *æther*, enveloped with an external one of *phlogiſton*, on the *rubber*. So that,

29. Sulphur, in its electric ſtate, reſembles a particle of earth in its alkaline, or aeriform ſtate; being a fixed centre, with an internal atmoſphere of æther, attracting an external one of phlogiſton: and glaſs, when excited to become electric, is like a particle of the acidifying principle, in its acid, or aeriform ſtate. The two fixed principles, in theſe ſtates, will attract each other, unite, and diſengage, at leaſt part of their external atmoſpheres: but the *oppoſite electric* atmoſpheres, will *both unite* with their *contraries*, and *totally ſeparate* in the ſtate of *fire*, or *light*; becauſe, they were not ſo ſtrongly attracted, by their reſpective exciting ſurfaces, as to be inſeparable; thoſe ſurfaces, in reality, only exciting them by virtue of the active principle, moſt excited and powerful in each.

30. Æther and phlogiſton in very different ſtates of excitement, have no action upon each other; for if æther be *greatly* excited, and phlogiſton but *gently* ſo, the *attraction* of *arrangement* between the particles of æther, will not give place to the *weaker attraction* of *union*, of the ſlightly excited particles of phlogiſton: ſo that in fact, a needle may be ſurrounded with a magnetic atmoſphere, an electric atmoſphere, with light, with fire, with air, and at the ſame time, with odorous particles, flowing off, or ſurrounding it in every direction, none of which, interfere with the other, but all preſerve their peculiar properties, and produce their proper effects, without interrupting each other.

31. When *æther* and *phlogiſton combine* and *ſeparate*, form ſolid bodies or principles, they may become *exciting baſes* to each other; in ſuch a caſe, if the *phlogiſton* be moſt excited, or active, it appears probable, that they form *Fire*, *which*, be that as it may, is certainly a compound of the two active ſubtile principles, and is capable of *pervading* every ſubſtance, and is ſubject to the laws of *fluidity*; having however, a peculiar attraction, or

power of combination with the *active principles* of all bodies.

32. By this general attraction to *active* particles, of *both* kinds, fire not only flows readily into the *ſpaces* left between the lines they form by arrangement, but alſo inſinuates itſelf between *each particle*; in conſequence of which, the atmoſpheres they form, become *extended*, and their attraction to their reſpective centres *weakened*; ſo that atmoſpheres of the contrary kinds, which *before*, were inactive, having as great an attraction to their reſpective centres, as to each other, *now* being further removed from thoſe centres, their attraction of *union*, or *tendency* to *unite* with each other, becomes *greater*, than their attraction of *arrangement*; in conſequence of which, they will now attract and decompoſe each other, firſt *drawing* their reſpective centres, or fixed principles into *contact*, and then *leaving* them, *combined together*, to unite *themſelves*, and *paſs off*, in the ſtate of *Fire*, or *light*. In every caſe however, its combinations ſeem to be thoſe of *neceſſity*, owing to the *quantity* of it preſent, as it readily *leaves* bodies, howſoever

accumulated, to *flow* into *other bodies*, containing a *leſs quantity* of it: except *thoſe*, containing *much æther*, with which it ſeems to have a peculiar affinity; and which ſeems to prove the conjecture, that the *phlogiſton*, entering into its compoſition, is *more excited*, or *active*, than its æther.

33. When æther and phlogiſton are ſeparated from their fixed principles, and combine, in a *certain* manner, they form *Light*; which, paſſes unaltered, and uninterrupted through bodies containing much æther, as ſeeming to have no attraction to them. But thoſe ſubſtances which contain *much phlogiſton*, *attract* and *detain* it in its paſſage through them; by which detention, it *loſes* its peculiar arrangement and properties, and is *changed* into *heat*, or *fire*; which gives ſufficient room to conjecture, that the *æther*, partly compoſing Light, is *more excited*, or *active*, or *expoſed* to *action*, than its other part, its phlogiſton is: and, as fire and light are compoſed of the *ſame principles*, and are *convertible* the *one* into *the other*, it ſeems probable, that their *peculiar properties* as fire, or light, depend upon the *phlogiſton* being

moſt active, or moſt expoſed to action when forming *fire*, and when the *æther* is moſt ſo, they become *Light*. Therefore we may ſuppoſe, that

34. *Different particles* of *Light*, have *different proportions* of *æther;* and that the *different ſtates*, or *degrees* of *excitement* of that *æther*, produce *rays* of *light*, acting upon the optic nerves with ſuch *different degrees* of force, as to produce the *ſenſations* of *different colours;* therefore,

35. Bodies, compoſed with *phlogiſton*, will naturally attract to their ſurfaces, the every where ſurrounding æther, and *that æther* will be in *different* ſtates of excitement, according to the ſtate of the combined phlogiſton of the body. When a ray of light falls upon a body of this kind, *thoſe particles* of that light, whoſe æther is in a *ſimilar* ſtate of excitement, with the æther ſurrounding the body, will be *completely repelled*, or *reflected*, and the body will appear to be of the *particular colour*, which *that* reflected ray, naturally excites in the eye: while the other rays, will be *partly abſorbed*, and by being mixed together, will produce

heat, or *fire*; and, being partly reflected, but with leſs force, or velocity, than the other particular kind, would produce a *dull white*, did not that *other ray*, *more perfectly* and potently reflected, overpower it. Therefore 'tis probable, that,

36. No bodies reflect any certain ray, or appear of any diſtinct colour, but thoſe ſurrounded with *æther*, in a ſtate of excitement, *ſimilar*, and *equal* to the excitement of the *æther*, of *ſome certain rays*, or *particles* of *light*; which particles, by that means are *reflected* with that degree of force, or velocity neceſſary to produce the ſenſation, or diſtinct idea of a certain colour; in all other ſtates, the rays of light are ſo reflected, as to produce the ſenſation of *white*, of different degrees of intenſity, proportionate to the force with which they are reflected; or if a *phlogiſtic* body, hath no ætherial atmoſphere, or none capable of reflecting any of them, they will be *abſorbed* and *changed* into *fire*, and the ſubſtance will appear to be *black*, and become *heated*, in proportion to the quantity of light abſorbed.

FINIS.

57